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COLONEL E. H. CLIVE, Grenadier Guards, Member of Council,  
in the Chair.

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ON THE INTERIOR ECONOMY OF A PRUSSIAN  
REGIMENT.

By Captain J. RUTHERFORD LUMLEY, late 13th Prussian Uhlans.

As exception may be taken to the appellation "Prussian regiment," instead of applying to my subject the more general term "German regiment," I would have you bear in mind that the Prussian system is the parent of the system now generally adopted throughout the German Empire, and that it was owing to it that the forces put into the field during the Franco-German campaign were twice as formidable as those employed against Austria but four years before, and I am convinced that from a similar cause the strength of the Empire would, if circumstances demanded it, prove to be at this moment thrice as great as it was at that time. For these reasons, as well as from the fact that the military forces of some of the German States are still in a period of transition, I have applied the word "Prussian" instead of "German" to my subject.

The interior economy of a regiment is so extensive and I fear so dry a subject, that I must confine myself solely to the principal questions which the term embraces, and ask your indulgence if I am unable to make my paper as interesting as I would wish and as the subject deserves. The points I desire especially to bring to your notice are—

- 1st. The equipment and maintenance of a regiment.
- 2nd. The financial control and arrangements.
- 3rd. The disciplinary powers of the Officers.
- 4th. The promotion of the non-commissioned officers.

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With regard to the equipment, the Colonel of a regiment is answerable for the efficient and proper equipment of his regiment, as well as for the correct disbursement of the funds confided to him for this purpose. In this matter he is aided by—

(a.) A "Bekleidung's Kommission," what in England would be termed "Clothing Committee."

(b.) By the Captains commanding companies, batteries, and squadrons, over the actions of whom he exercises his authority by supervision.

The "Bekleidung's Kommission," which is, as a rule, nominated every year, is composed of five members,—a Field Officer as President, a Captain, two Lieutenants, and the regimental Paymaster, the latter is aided by the Assistant-Paymaster, who, however, has no *locus standi* on the Committee nor voice in its deliberations. In a cavalry regiment, the Major is always the President, in the infantry, the Officer known as the 5th Field Officer. The other members are nominated by the Colonel on the recommendation of the President, who chooses them on account of some special recommendation, but their appointment is not permanent. In infantry regiments which consist of three battalions, there is, moreover, a battalion Clothing Committee, composed of a Captain, Lieutenant, and battalion Paymaster. The duties of the regimental "Bekleidung's Kommission" are—

1st. The management of the Equipment funds.

2nd. Purchase of all materials.

3rd. To supervise the proper making up and storage of all clothing and equipment:

4th. To distribute it to the companies and squadrons.

5th. To keep the account-books and inventories.

The Captains of companies and squadrons are answerable for all clothing and equipment issued to them by the "Bekleidung's Kommission," as well as for their proper keeping and maintenance.

As every regiment is obliged in case of war or mobilization to take the field with entirely new equipment for both men and horses, the Colonel is held responsible that the regimental "kammer" or store-room perpetually contains all articles requisite for this purpose.

The President of the "Bekleidung's Kommission" is responsible for the actions of the Committee. He allots to each member his special duties, and he again is personally responsible that nothing confided to him is lost or misappropriated, whilst as a control the Committee examine in a body every three months the books and inventories of the different sections. The purchase of materials or effects can only be made with the sanction of the majority of the members, while on all matters of importance, the approval of the Colonel must be obtained before any contract can be entered into. Every article of uniform, saddlery, under-clothing, &c., &c., is reckoned by the State at a fixed valuation, and has to be in use for a definite period, viz.:—

Tunic .....	2 years.
Non-commissioned officers' ditto.....	1 year.

Trowsers .....	1 year.
Breeches.....	1 year.
Infantry walking-boots.....	1 year.
Cavalry riding-boots.....	1½ years.

In fact, every article of clothing from a soldier's helmet to re-soling his boots, and of horse equipment from the saddle to the smallest strap, has its fixed value, time of wear, as well as the price of making and repairing, laid down, and according to the calculations derived from these sources, each regiment receives every year in advance the sum allowed it for the purchase and maintenance of its clothing and general equipment. Regiments having distinguishing badges are granted a fixed sum in addition to provide these, unless a fund exists for that purpose.

I have up to now treated my subject entirely technically, but will endeavour to explain how the matter is practically carried out, and how the system is worked, but I would before doing so, impress upon you the great advantage it enjoys from the fact that all regiments in Germany are always stationed in the same garrisons, and occupy the same barracks. Although you have heard a great deal about the "Bekleidung's Kommission," I must tell you that beyond being responsible, and checking the Paymaster, who is the real working member, and by whom, with the approval of the Committee and Colonel, all purchases are made and contracts entered into, it has very little else to do. It follows, therefore, that the good and economical equipment of a regiment, in the first instance, very much depends on the Paymaster, who is indispensable to the Committee and Colonel, not alone in the matter of equipment, but, as you will hereafter see, in nearly everything referring to the interior economy of the regiment. With the exception of its arms and ammunition, every regiment provides the whole of its own equipment, the raw materials, such as cloth, linen, leather, and all other necessities, being bought and made up in the regimental workshops under the supervision of the regimental masters—tailor, shoemaker, and saddler, who have the rank of non-commissioned officer. These are aided by soldiers known as "Economie Handwerker;" 20 of whom are carried on the strength of every cavalry, and 36 on the strength of every infantry regiment. These men are selected from among those least fit physically for military duties, but it is essential that they should have been brought up to the trades in which they are to be employed. Besides their pay as soldiers, they receive a small addition from the regiment. Should extra hands be required to get through the work, the wives of non-commissioned officers may, if willing, be employed to do it in their quarters, for which they are paid by the regiment according to agreement.

Every regiment has what is termed the "Regiment's Kammer," and every squadron an "Escadron's Kammer," or as we should call them, regimental and squadron store-rooms. The "Regiment's Kammer" contains first and foremost *an entire new equipment for a mobilized regiment*, which includes the necessary articles for the reserve men when called up, and all extra effects which have been saved by good management

and economy, as well as all raw materials. The "Escadron's Kammer" contains all clothing and equipment which has been served out to the regiment by the "Bekleidung's Kommission," and which is not in the possession of the men; the articles stored here consist as a rule of two entire suits of uniform for each man, and an entire equipment for the horses, as well as a reserve of all other necessities. In the regiment in which I had the pleasure of serving, each man possessed five complete suits of uniform, and three helmets; besides these were three sets of equipment for the horses. Sir Frederick Roberts, when I was showing him over the store-room of my late regiment last September, was very much surprised at the large reserve of clothing which the regiment possessed. Seeing the men were also uncommonly well dressed, he wished to know if they had their extra uniform on or were wearing that served out and kept by them. I recommended him to ask the first man he met, who at once stood at attention, and answered, "Fourth ulanka and third pantaloons, Herr General!" As a general rule, it may be accepted that every man has two complete suits of uniform in the regimental "kammer," one which he never wears except when called to go on active service, the other which is served out to him on grand parade days; in the squadron "kammer" he has his Sunday and inspection uniform, the two others being in his own possession; but this depends entirely on the will of the Captains. A non-commissioned officer, called "regimental quartermaster," keeps the keys of and maintains order and cleanliness in the "regiment's kammer," while the same duties in the squadrons are done by the squadron quartermasters, who also have to keep an inventory of all articles, and for which they are directly responsible to the "Bekleidung's Kommission" and Captains commanding companies and squadrons respectively.

It will be seen that both the regiments and squadrons have great opportunities of saving their equipment by economy and good management. It is therefore not astonishing that some regiments are much better dressed than others, while in the same regiments one squadron will likewise be smarter than another; in the former case it is due not alone to good management, but also because the raw materials have been bought and made up less expensively, while in the latter it is due to the greater care taken by the Captains.

No equipment of any kind nor any raw materials are allowed to be issued to the troops before they have been examined and approved of by the "Intendantur" or "Control Department" of the army corps. Out of the funds allowed for equipment, no savings are permitted to be put aside for other purposes, but extra equipment must be purchased, although whether it be boots, tunic, or saddles, is left to the discretion of the "Bekleidung's Kommission." This will account for the large reserve of things that exists.

The regiments and companies have to keep inventories of everything bought, issued, and received by them respectively, and by these the contents of the "kammers" are controlled, an inspection of them taking place every year by the "Intendantur Department" in the presence of the divisional or brigade Commander. Likewise all the

accounts are inspected yearly by the "Ober-Rechnung's Kammer" in Potsdam. All articles of equipment are issued to the men free of charge, and no man can be put under stoppage of pay on account of loss or destruction of his effects, but he is liable to be punished according to his culpability; as all articles of uniform belong to the Government, the act of receiving or disposing of any of them is felonious, and is punished as such.

I will now touch upon the subject of maintenance. Bread is the only article given in time of peace to soldiers without payment; of this, his ration is  $1\frac{1}{2}$  lbs. a day; it is baked in the garrison bakery, and is issued to the troops on the receipt of the Officers commanding. Every soldier, unless he be an Officer's servant, has to join the mid-day meal, for which 13 "pfennigs," or about  $1\frac{1}{2}d.$ , is deducted from his pay, which is 12s. a month. The Government, however, add to this amount the necessary contribution to make the daily ration per man  $\frac{1}{2}$  lb. of meat, 3 ounces of rice,  $\frac{1}{4}$  lb. of porridge,  $\frac{1}{2}$  lb. of peas or beans, and 3 lbs. of potatoes. The meat is purchased standing or by contract, likewise all other provisions, and are handed to the non-commissioned officer in charge of the regimental kitchen. All accounts are kept by the Paymaster, who is controlled by the "Menage Kommission," acting under orders of the Colonel, who nominates its members; they consist of a Captain, Lieutenant, two non-commissioned officers, and a lance-corporal or soldier. The canteen is the property of the regiment, and the profits made from it are handed over to the "Menage Kommission," to enable it either to give an extra meal or to add to the midday dinner of the men. In my regiment, the men received an extra morning meal of porridge. In this matter, as in that of equipment, the Colonel and Committee have great liberty of action, which enables them to act very materially for the benefit of those they represent. All accounts are controlled by the "Ober-Rechnung's Kammer."

I now turn to the second point of my subject, viz., the financial arrangements, as carried out in a regiment, and which are controlled by the "Kassen Kommission," or "Financial Committee," consisting of three permanent members, the Colonel, Major, and Paymaster.

The regimental safe containing all the regimental funds and securities, is kept in the Colonel's quarters, each member of the Committee having his own key, and the safe is so constructed that it cannot be opened except by the simultaneous action of all three members. The Colonel is answerable for, and controls the entire management of the regimental funds, and on him devolves the necessary precautions for their safety as well as for the correct receipt of all moneys drawn on behalf of the regiment. On the Major devolves the special duty of controlling the actions of the Paymaster, and of seeing that his accounts and books are properly kept, and all formalities required by the authorities complied with.

The Paymaster keeps all regimental accounts, and conducts all correspondence referring to them; he draws and pays out all regi-

mental funds, but when doing the former, he is always accompanied by an Officer ordered by the regiment to be present, and they conjointly hand over personally to the Colonel the amount received. When payments are to be made, he reports to the other members of the "Kassen Kommission" the amount required; they then assemble, and allow the requisite sum to be taken from the regimental safe.

All correspondence appertaining in any way to the finances of the regiment has to be addressed to the Colonel, who lays it before the other members of the Committee. All answers are in the name and bear the Colonel's signature, but have to be written and attended to by the Paymaster, who has the Assistant-Paymaster and two regimental Clerks to carry out his orders. The Paymaster keeps an account for every Officer, which he lays before him every month to approve and receipt. On the last day of every month the regimental accounts have to be made up and balanced with the sum in hand; this having taken place, an entry is made to that effect in a journal kept for the purpose, and signed by the three members of the Commission. A copy of the accounts has at once to be forwarded to the Pay Department of the Army Corps. Besides these monthly revisions of accounts, the regimental safe has to be unexpectedly examined at least once every quarter by a member of the "Intendantur;" this examination has to take place immediately after the order has been presented to the Colonel. The Intendantur Officer notifies in the books that such examination has taken place.

All duties regarding the "Kassen Kommission" are part of the military duties of its members, who are individually responsible for all loss, unless it can be proved that the loss has occurred from no fault of their own. For any loss that may occur through the negligence of his duties by any one of the members, they are conjointly responsible, so far as their duties demanded the control of his actions. As with the equipment, so likewise with the regimental finances, the Paymaster is the working factor. He also holds a similar position regarding the accounts of the companies and squadrons, which, as far as the responsibilities and difficulties are concerned, are very slight and simple when compared to those of Captains commanding English companies. In a Prussian regiment, the Captains of companies have no separate account to keep with each man, although they are responsible for the proper payment of their men; but this is done in a very simple manner. Every soldier receives his pay on the 1st, 11th, and 21st days of each month, on which dates the serjeant-majors receive from the Paymasters the sum necessary for these payments. The only deduction made being for men in hospital, a return of whom is made daily to the Colonel, who forwards it to the Paymaster, the latter knows exactly the amount he has to give to each Serjeant-Major. On the first day of every year each soldier is given a pay-book, which contains a cheque for every pay-day of the year. The men are paid by the serjeant-major in the presence of one of the Officers of the company, who extracts the cheque for the payment made to the man; besides this, the serjeant-major keeps a company pay-book which he and the Officer who was present at the payment sign, after the

former has asked the men if any one has any claim or complaint to make, warning them that if not made at once, nothing of the kind will be entertained afterwards. The Captain of the company gives a receipt to the regiment for the money paid to his men. Every company and squadron has a fund, maintained by its savings and perquisites, out of which gratuities are given to deserving non-commissioned officers or to the squadron's entertainment on the Emperor's birthday. To go into details of the working of this fund would take up too much time, but I shall be very glad to answer any questions regarding it, and will pass on to the third point of my subject.

The disciplinary powers accorded to Officers over the men, as well as the punishments to which they are liable, form a very prominent feature in the Prussian military system, and have in my opinion conduced as much as anything else in bringing about the high moral as well as efficient state the army now enjoys. Few people are aware that a man who has, before his time comes to enter the Army, been guilty of felony or any other crime is not allowed to become a soldier, and if guilty of these crimes while still liable for service, he is at once dismissed the Army. Although it is not my intention to enter on the judicial system of the whole Army, but to confine my remarks to as far as it concerns a regiment, still I must make a few general observations by way of making myself more clearly understood. No soldier can be tried by a civil Court, but is subject to the same punishment, and for this purpose a lawyer, called an "Auditor," is attached to each division, on whom devolves the duty of expounding the law to the members of a Court-martial. The judicial laws and punishments to which soldiers are liable are, so to say, divided into three categories:—

a. A General Court-martial, "Krieg's Gericht," instituted by the order of the Officer commanding the division.

b. A Regimental Court-martial, "Stand's Gericht," ordered by the Colonel.

c. Disciplinary punishments imposed by Officers commanding squadrons and companies, and all those of higher rank.

A General Court-martial is composed of five classes in case of a private:—

a. A Field Officer as president.

b. Two Captains.

c. Two Lieutenants.

d. Three non-commissioned officers.

e. Three privates.

As the military rank of a prisoner increases, so do the members of the Court-martial, class *e* representing the rank of the man to be tried. The "Auditor" collects all evidence referring to the charge, so that when the Court-martial assembles, nothing has to be done, beyond that he should read the whole of the proceedings in the presence of the prisoner, who, at the conclusion, is asked if he has anything to say. The "Auditor" then explains to the members the legal points of the question, and what punishment the law lays down for the

offence; the classes then consult together, and give their verdict, which must be unanimous as far as each class is concerned. When the "Auditor" is taking the evidence previous to the Court-martial, an Officer is always present to maintain order and guard the interest of the accused.

In cases of "Stand's Gericht" or Regimental Court-martial the Court is likewise composed of five classes under the presidency of a Captain. Only privates and non-commissioned officers can be tried by Regimental Court-martial. In every regiment there is an Officer called the "Untersuchungs fuhrenden Offizier," who, like the "Auditor," in cases of a General Court-martial, collects the evidence and reads it to the members. This Officer receives a small increase of pay, and has to take an oath to perform the duty allotted to him impartially and to the best of his judgment and ability; in every other respect the proceedings are similar to those at a General Court-martial. Disciplinary punishments, as I before mentioned, can be given to Officers and men by Commanders holding independent commands, viz. :—

*For Officers.*

- a. A reprimand in the presence of a superior Officer.
- b. A reprimand before all the Officers of the regiment.
- c. A reprimand in general orders.
- d. Arrest from 1 to 14 days.

These punishments can be given to any Officer by the Senior Officer in command of a detachment irrespective of his rank.

*For Non-commissioned Officers.*

- a. A reprimand in the presence of an Officer.
- b. Ditto before all the Officers and non-commissioned officers of the company or squadron.
- c. Ditto in regimental orders.
- d. By imposing extra guards and duties.
- e. By arrest—confinement to barracks or to quarters—by four weeks' solitary confinement and by three weeks' middle arrest.

*For Privates and Lance-Corporals.*

- a. Extra duties, viz., drills, guards, and fatigues.
- b. Ordering them to be in their quarters at a fixed hour before the retreat is sounded.
- c. By arrest—confinement to barracks or quarters, and to four weeks' solitary confinement.
- d. Middle arrest for three weeks.
- e. Severe arrest for 14 days.
- f. Lance-corporals can be reduced to the ranks.

Having mentioned all the disciplinary punishments to which Officers and men are liable, I will simply add the maximum that it lies in the power of regimental Officers to inflict.

*By the Colonel.*

1. Six days' arrest to Officers.
2. Three weeks' middle arrest to non-commissioned officers.
3. Fourteen days' severe arrest to privates.

Captains and Officers commanding companies and squadrons can give non-commissioned officers and men, besides the lesser punishments already mentioned' 8 days' solitary confinement, 5 days' middle arrest, and 3 days' severe arrest. Field Officers other than the Colonel, as well as Captains or Officers commanding companies and squadrons can, when detached, give Officers 3 days' arrest, non-commissioned officers and men 14 days' solitary confinement, 10 days' middle arrest, and 7 days' severe arrest.

As the terms "middle" and "severe arrest" may not be understood, I will explain them. Non-commissioned officers and men are liable to three different kinds of arrest called "Geline," "Mittel," and "Strenge" arrest, of which 1 day's "Mittel arrest" is equivalent to 2 days' "Geline arrest," and 1 day's "Strenge arrest" to 2 "Mittel arrests." All are endured in solitary confinement, but differ as follows: When undergoing "Geline" or mild arrest, the prisoner has a bed to sleep upon, and his ordinary food; while in the case of "Mittel arrest," he has to sleep on a deal board, and is fed on bread and water. "Strenge arrest" or severe arrest is the same as "Mittel arrest," with the addition of darkness. Under no circumstances is a man subject to a pecuniary fine. Soldiers dismissed the Army during their time of service, as well as those who are not allowed to become soldiers on account of previous misconduct, serve their time in what are termed "Arbeit's Abtheilunge," working companies, and are employed on public works and fortresses.

In the case of Officers, they are not only subject to be tried by Court-martial and liable to disciplinary punishments, but also to a tribunal called the "Court of Honour," which controls and inquires into any action of doubtful character reflecting on any Officer that may be brought to its notice.

I have now come to the fourth and last part of my subject, viz., "the promotion of, and provision made for the non-commissioned officers who, with the Officers, form the standing Army of the nation. During the prosperous times that followed immediately after the Franco-German campaign, the difficulty in obtaining good non-commissioned officers was somewhat great, as men of good character and intelligence commanded good salaries in the various new enterprises set on foot. But when, in 1875, the bad times came, the class to which they belonged soon discovered that in the long run it was better to serve their time so as to qualify for a civil appointment than to accept a more alluring offer which might, however, come to an end at any moment. The consequence is, that at the present time there is no difficulty in obtaining non-commissioned officers. Men intending to become non-commissioned officers, as a rule, enlist voluntarily for four years, and the Captain, being thus aware of the fact, keeps the man specially in

his eye, as he recommends for promotion his own non-commissioned officers up to the rank of serjeant. In the regiment with which I served, a man who was qualified to become a non-commissioned officer generally obtained the rank of corporal during his fifth year's service, and of serjeant after seven years. Having obtained the latter rank, all the serjeants are placed, according to seniority, on a regimental list for promotion to the rank of serjeant-major, which is in the nomination of the Colonel, who, however, is not solely influenced in his selection by seniority, but more by the reports of the Captains. During the ten years I served in the 13th Uhlans, only one vacancy occurred among the serjeant-majors of the regiment, none of whom, when I left, had less than twenty-five years' service. Non-commissioned officers, after twelve years' service, are entitled to what is termed a "*Civil Versorgung-Schein*," and after fifteen years' to a "*Civil Ausstellungs-Schein*." The difference between these two categories of certificates (which literally mean certificates for civil employment and to a civil appointment), is that the holder of the latter has a prior right to any appointment for which candidates of the former are applicants. In both instances these certificates can be held while the holder is still in active military employment. Non-commissioned officers who obtain a civil appointment are not entitled to a pension, unless they have served twenty-five years, when they can have both. Non-commissioned officers and men who are invalided on account of wounds are entitled to a "*Civil Versorgung-Schein*," independently of the number of years they may have served. A sum of 10*l.* is given to every one entitled to a civil appointment to start him on taking it up, or to help him to look after one should he leave the Service before having secured it. It would take too long for me to enumerate the appointments thus given, but as they vary in value from 60*l.* to 120*l.* a year, they are looked upon as a provision for life by men of sober habits and inexpensive desires. As in the case of Officers, the wives of non-commissioned officers are obliged to have some private means, for which the Government allow 5 per cent. interest as long as the husband remains in the Service.

A non-commissioned officer having left the Army to take a civil employment, or before he is entitled to such, and afterwards regrets the step he has taken, can re-enter should he find a Captain willing to accept him; his former service on such occasions is again recognized. A non-commissioned officer who has been reduced to the ranks can never again be promoted, and loses all claims he may have for civil employment. After seven years' service, Captains enter into contracts with their non-commissioned officers to serve from year to year. This enables them to get rid of any non-commissioned officer with whom they are dissatisfied, while the latter can, if he wishes or is able to better himself, leave at the end of his engagement.

In conclusion, I regret to say that time does not allow me to enlarge upon the subjects of Officers' messes, band subscription, and the Officers' uniform fund, which I should much like to do, but I shall be most happy to answer any inquiries on these subjects, should any one present be interested to hear about them.

In thanking you for the kind attention you have given to a somewhat dry subject, I hope I may be allowed to remark that the object of my reading this paper was not to advocate in any way the adoption of the Prussian system, but to place before those interested in military matters the results of my experience, which, unfortunately, the regulations of the Service compel me to do in words rather than in deeds.

Sir LUMLEY GRAHAM : I should like to ask for further information, if Captain Lumley will be kind enough to give it us. First of all, with regard to the clothing, I should like to ask whether he can tell us what sum is allowed for the clothing of each soldier from the regimental fund, and for the equipment of each horse, per annum. Then with regard to the trial of soldiers, I understand him to say there is an Officer called an Auditor, who collects all evidence referring to the charge previous to the trial. I wish to know whether he does so in the presence of the prisoner; whether, in short, there is a regular trial before the Court-martial, or whether the evidence is collected by the Auditor in the absence of the prisoner? Then, when the trial takes place, am I right in understanding that there are no witnesses examined as to the charge?

Captain LUMLEY : None.

Sir LUMLEY GRAHAM : Therefore the prisoner has no opportunity of cross-examining witnesses?

Captain LUMLEY : None on that occasion.

Sir LUMLEY GRAHAM : Has he on any other occasion?

Captain LUMLEY : I will deal with that in my answer to the first question.

Sir LUMLEY GRAHAM : But at the trial there are no witnesses?

Captain LUMLEY : None.

Sir LUMLEY GRAHAM : Therefore the members of the Court have no opportunity themselves of examining witnesses.

Captain LUMLEY : None.

Sir LUMLEY GRAHAM : With regard to the summary punishments that can be inflicted, Captain Lumley mentions that one of the punishments is to confine privates and lance-corporals to barracks. He has not stated the maximum time for which a soldier can be confined to barracks. With regard to the marriages of non-commissioned officers, I should like to ask whether there is any limit as to the number of non-commissioned officers in the regiment who are allowed to marry, or whether all can marry if their wives can comply with the regulation as to means. Then I should like to know whether the wives and families of non-commissioned officers on the strength of the regiment have any privileges as to quarters, rations, &c. Captain Lumley was kind enough to say he would answer any questions about the Officers' subscriptions to messes. Can he tell us the amount of expense that an Officer of a Prussian regiment is put to for messing? Also whether the band is supported by the regiment partly or entirely? Lastly, how the uniform fund is managed?

The CHAIRMAN : If no other gentleman desires to favour us with any remarks, I should like to ask one or two questions, mainly referring to the points that Sir Lumley Graham has alluded to. First, if it is clear that the sergeant-majors of the companies are not appointed by the Captains? The paper says, "The rank of sergeant-major, which is in the nomination of the Colonel, who, however, is not influenced in his selection by seniority, but more by the reports of the Captains." There is one sergeant-major to each company?

Captain LUMLEY : Yes.

The CHAIRMAN : That is in the nomination of the Commanding Officer?

Captain LUMLEY : Supposing a vacancy occurred in the fifth squadron, and the senior sergeant was in the first, and he was reported upon by the first Captain, he would get the sergeant-majorship of the fifth. It is regimental seniority.

The CHAIRMAN : Captain Lumley also spoke of the non-commissioned officers contracting to serve their Captains after the first period of four years, for three years, and then for year after year. I suppose you mean sergeants?

Captain LUMLEY: All are termed "non-commissioned officers." A man would hardly be a sergeant till after seven years.

The CHAIRMAN: But he would be a non-commissioned officer.

Captain LUMLEY: He would contract from year to year from that date.

The CHAIRMAN: I would ask Captain Lumley whether, for the information of the readers of the Journal, he will give us some information regarding the Officers' messes. It would also be interesting to the public generally, as attention is now much directed to those points. There is one other question I should like to ask, and that is with regard to disciplinary punishments. What we are anxious to know is whether there is such a thing as corporal punishment. I have heard stories that every now and then a German soldier is liable to a certain amount of corporal punishment. Notably, I recollect reading in a book called "*Wachstuben Abentheuer*," which no doubt several gentlemen have read, that, at the inspection of a division, as one company was passing the post a man tripped over a molehill and fell down. The General said to the Brigadier afterwards, "I was very much pleased with your brigade, but I observed that one man fell down as they were marching past. I hope he was not hurt." The Brigadier went home and said to the Colonel, "Your regiment has disgraced itself on the field, and the Divisional General was obliged to speak very strongly to me about it." The chain of responsibility goes through the German Army. The regimental Colonel passed the message on to the battalion commander, and he to the Captain, with continually increased strength, and he to the section sergeant, and the last scene presented a picture of poor Hans being dragged along by the ear round the barrack-yard. I should like to know whether these things are only fables. Without further delay, I am sure I may say this lecture has been most interesting. But, after all, the principal advantage of these lectures, independently of the interest of the subject, centres in the means that they afford us of contrasting other systems with our own, with the view to the improvement of the latter. I venture to think that the interior economy of a Prussian regiment could not be applied in this country. The whole system breathes a fatherly spirit of protection. A constant danger of invasion necessitates heavy sacrifices, both in purse and in person, to the citizens, who in turn are rewarded by the State for their service to the State. The required tale of men is taken for the Army *volens volens*. They are well fed and clothed. If they marry, they can only do so under certain conditions, such as the wives having pecuniary means of their own; if they are punished, their peers sit on their Court-martial; and after good service they have the refusal of State employment. But all hinges upon the obligation upon every man to serve in his own country for the defence of that country. With us this obligation is fully conceded; but the necessities of our extended Empire oblige us to keep one-half of our Army serving always abroad, consequently enforced service does not and can never apply. For our requirements we must have voluntary enlistment and free contract between the Government and the man intending to enlist. Our soldiers must be prepared to carry their wardrobe as well as their arms, and hold themselves in readiness to embark for any part of the world. Therefore we must get our men of their own free will, pay them liberally, and treat them well while serving, and after their service we admit no claim by them upon the Government. I speak of course of the bulk of our Army, who leave after short service of from three or four to seven and nine years, and not of old re-engaged non-commissioned officers. For these reasons, gentlemen, I hold that, while the system which Captain Lumley has so well described is the best for Germany and the German Army, our system is undoubtedly the best for the British Army and the British Empire.

Sir LUMLEY GRAHAM: Might I ask one more question with regard to disciplinary punishments? Though corporal punishment is not permitted in the German Army, I know that in war time there are various punishments, which may not be actually in the Military Code, but which are carried out. I should like to ask Captain Lumley whether, when he was in France during the war, he ever saw a case of a German soldier tied up to a tree and kept there for some hours in a public place on account of some breach of discipline, or whether he knows of any other punishments of that sort which are not actually in the Code.

Captain LUMLEY: I will endeavour, as far as lies in my power, to answer the

questions which have been put to me. First, with regard to the sum allowed for each man and each horse. The amount is reckoned in this way. Take the case of a coat. So many yards of cloth are said to be sufficient to make a coat. The quantity is positively laid down, but I could not tell you whether it is two, three, four, or five yards; 7 marks a yard is the price allowed, while for making it up, 2s. more. The regiment make up their own clothing, and perhaps they save at least 1s. by so doing, as the regiment buys the cotton and all the necessaries for making it up, and the whole of the work is done in the regimental rooms by the men. I cannot tell exactly, but I think something between 8d. and 1s. is paid for each coat. Thus the regiment profits 1s., which is so much saved. In buying the cloth, contracts are entered into by the regiment with merchants. There are different prices allowed for different colours, blue cloth, 7s.; red cloth, 8s. The amount is fixed. There being so many men in a regiment, so many yards of cloth are allowed per year to the regiment. With regard to boots, 10s. is allowed for infantry walking boots, and 15s. for cavalry boots. They can either contract to have them made at that price, or buy the leather and make them up for themselves, the regiment taking the difference. Before a contract is entered into, it has to be laid before the Control Department. All raw material has to be inspected before it can be put into work, and has to be passed as "Good." Should that not have been done, and afterwards when the things are made up the Intendantur Department declare them not to be serviceable, the Colonel of the regiment has to refund the whole amount. He is made answerable for the amount. Linen and saddles are dealt with in the same way. I believe an Hungarian saddle is reckoned at 36 marks, a Cuirassier saddle at 78 marks. An official list is furnished to every regiment, and can be seen in the regimental orderly room, with the price, and the number of years that the saddle has to last, namely, ten years. In my regiment, which was formed from the Lancers of the Guard in the year 1866-67, the men brought one complete horse-equipment with them. They were also allowed a new equipment on the formation, while ten years afterwards, in 1876-77, they got a third. The first one which they brought with them was still in use for ordinary drills, patrol duties, or ordinary service; but on inspection days the saddles issued in the first instance, in 1876, were given out, and I suppose in 1886 those issued in 1876 will be taken into general use, and the first discarded. It depends a great deal on the management of the Colonel and Captains how long the articles remain in use. It is not officially recognized, but I know that the Intendantur Department recommend the Paymasters to the Government for certain gratuities in case of big savings. When the inspections of clothing take place, and they find a regiment well taken care of, they recommend the Paymaster for a gratuity; but I must say this for the German Paymasters, that I never heard of an instance of anything being done which savoured of an attempt to obtain pecuniary advantage. Then with regard to the trial of soldiers, Sir Lumley Graham wished to know if the evidence brought forward was taken in the prisoner's presence. It is always taken in his presence. Before a man is committed for trial before a Divisional Court-martial, each witness appears and in the presence of the prisoner gives his evidence, who can there and then cross-examine him, or have him cross-examined by a friend.

Sir LUMLEY GRAHAM: Are the witnesses on oath?

Captain LUMLEY: All witnesses are on oath, but it is done to save the time of the Officers, who have not leisure to devote to Courts-martial. In Germany you try a man in half an hour or an hour, while the preliminary proceedings have taken days and days. All the evidence is taken and signed on oath, in the presence of the prisoner, and of an Officer, whose duty it is to protect the prisoner's interests while this is being done. When a Court-martial assembles, an oath is administered to the members, to whom all evidence is read and the law expounded by the Auditor, judgment being given accordingly. The verdict is not according to the individual vote, but according to the vote of the different classes. There are five classes. Supposing the non-commissioned officers and the privates vote one way, and the Captains and Lieutenants another way, then the vote of the President decides the punishment.

The CHAIRMAN: Is it considered a satisfactory tribunal?

Captain LUMLEY: I have never heard any dispute about it.

Sir LUMLEY GRAHAM: In the case of the trial of an Officer is it the same?

Captain LUMLEY: If it is for a military offence it is in the same way: if for a personal offence affecting his honour he is tried by the assembled Officers of his regiment. He can choose to be tried by Officers of another regiment should he prefer it; at such trials the votes are given secretly by each Officer, so that there shall be no influence brought to bear by the seniors on the juniors. Each Officer delivers his sealed decision, and according to the decision of the majority, is also the verdict. With reference to confinement to barracks, the Captain can confine a soldier to barracks the whole time he is serving. If I had a man who was a bad character, and got his corps into disgrace, I should simply confine him to barracks and never let him go out. They can confine them as often as they please; there is no limit; but the other punishments are limited. With regard to the non-commissioned officers, they can all marry; but the wives of only a certain number are allowed to have quarters in barracks. A certain number per regiment, according to the accommodation of the regiment, are given quarters in barracks; but the wives of non-commissioned officers are in no way recognized beyond their being allowed to live in barracks; they have no right to rations or anything whatsoever. They have to have certain means, to prevent their coming and saying that they are reduced to beggary. I think the means they require is 80*l.* or 100*l.*; and if such a case were to arise, then they would give her a portion of that to keep her going. But no non-commissioned officer can marry without permission of his Captain; and the Captain is bound to see that the woman is a respectable person. With regard to the Officers' messes, the band, and so forth, very few people in England know that the Prussian Army has messes; and, moreover, the system of the Prussian Army is one entirely based on the necessity of maintaining messes. The Government are so far impressed with this that after the war of 1870 a great portion of the money allotted to the different regiments for regimental purposes was expended, by order of the Government, in providing messes. Every Officer who is not married is bound to dine at mess; and he is put under a severe fine—which is not, however, recognized by the Government—if he is absent from mess three consecutive days in a week without special reason; as it is the opinion that the *esprit de corps* and *cameradschaft* lies in the social intercourse between one and the other, and that this is endangered when Officers abstain from coming to mess. The Emperor sets the example by maintaining and upholding the regimental mess system. The price of messing varies in regiments according to the means of the Officers; but there is no regiment in the Prussian Service which does not mess for 2*s.* a day. My regiment was one of the most expensive in the whole Prussian Army, because we were stationed in Hanover, where Officers are sent from every German regiment for two years to the schools of equitation; and we had to be the first regiment in the place, and our tables had to be the best; but our messing only cost 17½ groschen, 1*s.* 9*d.*, for members who dined every day, and 2*s.* for those, the married men, who only did so occasionally. For this a dinner was provided, consisting of a very good soup, a very good *entrée*—what they call "*beilage*": it was either cutlets, with vegetables, or something similar; afterwards a roast joint with salad and *compotes*, and bread and cheese, and a cup of coffee to follow. That was the ordinary dinner, while on Saturdays, which was a guest night (you could always bring a guest if you liked) the mess-man had to provide soup, fish, two *entrées*, joint, pudding, cheese, and coffee. I do not know if there are any of them here, but many Officers have dined with me in Hanover, and have been very much astonished when they heard the prices we paid. I do not think things are cheaper there, but rather that the system is more economically carried out. The mess-man is provided with everything free of expense. He is given a kitchen, fuel, and attendance, only buying and cooking the things which he has to provide for the Officers' table. What remains he sells to the non-commissioned officers, or can serve it up for luncheon, or any other meal, and then charge whatever he pleases. It depends entirely on the Officers whether they will take it or not. They need not go to breakfast or luncheon, and most of them do not go to breakfast, but nearly all to luncheon. The mess-man has also the sale of all the beer. The wine is vested in the Officers themselves. Every regiment receives an allowance, similar to the Regent's allowance here in England, and which is meant to be divided amongst the

Officers who dine at mess, but instead of this the linen, washing, and all the table necessaries are provided with it. Every Officer on joining his regiment is asked to contribute three sets of service—three soup spoons, three tea spoons, three big knives, three little knives, three big forks, three little forks, &c.; the whole thing comes to about 10*l.*; his name and his coat of arms are engraved on these articles, which remain as a heirloom to the regiment. The date of his joining and leaving is also put on them. Presents of plate, and so on, are made in the same way as in England. They are never bought.

A MEMBER: Would you tell us about the mess premises, what rooms are provided?

Captain LUMLEY: Almost always in barracks, but in some instances they are in the town. All the new barracks have mess premises for the Officers, and are furnished by the Government. So much is allowed to a regiment for the furniture, which has afterwards to be kept up by the regiment. There is a rule that a regiment takes 2*½d.* or 3*d.* on every bottle of wine that is drunk, what they called "cork money." When the wine is bought, the mess committee assemble and say:—"That wine has cost so much: now we can sell it at such and such a price, *plus* 3*d.* per bottle, which goes to the mess fund." With reference to the bands, they are in themselves self-supporting to a great extent, because the bandsmen are allowed to go out and play, and for which they are paid; but any private engagements they may take are in no way allowed to interfere with their duties. If they can go and play and do their own duties too, they may earn as much money as they please. The Government only furnishes cavalry regiments with trumpets, but every Officer pays a band subscription of 2*s.* 6*d.* a month.

Colonel MACKENZIE: I should like to ask whether the Officers in the infantry mess together by battalions or by regiments?

Captain LUMLEY: In Hanover, where there are three regiments of three battalions each, each has a barrack of its own, and each regiment has its own separate mess. In Coblenz there is a general mess, where all the regiments in garrison, except the Guards, mess together. The Guards have their own mess.

Colonel MACKENZIE: Officers of all ranks together?

Captain LUMLEY: There is no difference socially. It is not like in the French Army, where Colonels mess together, and Captains together. In the mess room, saving the respect which every younger man owes to his senior, there is no difference. The president of the mess, who is elected president for one year, and not daily as in England, is generally a First Lieutenant.

Sir LUMLEY GRAHAM: That is only since the war?

Captain LUMLEY: The system of messes has been introduced since 1866, and it is now very nearly general throughout the whole army in Prussia. In the Southern German States it is not yet so. In out-of-the-way garrisons where there is only a squadron, there, of course, cannot be a mess, and the Officers dine at the hotels. With regard to the uniform fund, every Officer is obliged to allow 18*s.* a month to be deducted from his pay and to be placed to his uniform fund; with this 11*l.* he is expected to provide himself in uniform. No tailor can sue an Officer for a larger bill than that. He can give him credit if he likes, and the Officer is in honour bound to pay him, but he cannot go to law.

The CHAIRMAN: A civilian tailor?

Captain LUMLEY: Yes. The great advantage of this uniform fund is that the regimental master tailor and bootmaker are obliged to furnish the Officers of the regiment with their uniform at a certain price. He is allowed to charge a little more for better cutting and working, but the price is that laid down by the Government. I always got mine made there, and always got them at two-thirds, or less than two-thirds, of the price that any civilian tailor would have charged. Every Officer is obliged to contribute to this fund, and the regimental tailors, if you employ them, have a first right to it. With regard to the further question that Sir Lumley Graham has raised respecting "corporal punishment," corporal punishment is absolutely forbidden. Every Officer striking a man is liable to be dismissed the Service, and every non-commissioned officer striking a man is likewise liable to be dismissed. Any man who has been struck has a right at once to bring the matter before the notice of the Commanding Officer, and the Commanding Officer is bound

to forward it to the higher authorities. It is a military offence, and you are tried by Court-martial, and punished according to the law laid down, there is no getting over it. Men are struck, but the Officer doing it runs the risk of the punishment. I think now, as education is advancing, and the men are getting to know more about these things, the offence is much less frequent. When I entered the Service, fourteen or sixteen years ago, it was more in vogue. When I left, it very seldom occurred. In the time of war, I have not only seen soldiers tied up to trees, but also the mayor, sheriffs, and the whole of the chief people of a town lining their own boulevards. In time of war, you have no black holes, no places of confinement, and therefore it was the best punishment for a man who misbehaved himself if you could not send him back to Germany. My Christmas Day, 1870, was spent in trying some men who took some shirts from a peasant, and refused to give them up. They were sentenced, and sent back to Germany. It was an act of dishonesty, and therefore they were sent back as being unfit to be soldiers. But if a man simply committed a breach of military discipline, or assaulted a person, he was tied to a post and left there the whole night. The punishment certainly had a good effect, and the men very seldom did it again. I have been told by men who have been tied up all night, that it is a very nasty punishment.

The CHAIRMAN : With your permission I will offer to Captain Lumley a vote of thanks for the admirable way in which he has delivered the lecture, the great care with which it has been got up, and the extreme facility with which he has answered every question. I only wish to add this, that one thing we ask for in this hall is *knowledge*—information from other countries of how other people are working their affairs; and those Officers do us the greatest service who bring us the knowledge they have obtained during their services, and who give it us as lucidly as Captain Lumley has done.

Friday, May 5, 1882.

GENERAL SIR J. LINTORN SIMMONS, G.C.B., R.E., in the Chair.

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A SHORT NARRATIVE OF THE AFGHAN CAMPAIGNS OF  
1879-80-81, FROM AN ENGINEER'S POINT OF VIEW.

By C. HOSKYNs, Captain R.E.

It is entirely beyond the province of this paper to enter into any discussion on the political causes which led to the late Afghan War. It is, therefore, sufficient to state that an ultimatum was sent to the Ameer stating that unless the English Mission, under Sir N. Chamberlain, was allowed to proceed to Cabul by the 20th November, 1878, the English troops would cross the frontier.

Between the two dates, 21st September and 20th November, the Indian Government massed troops at various points on the north-west frontier:—

		Men.	Guns.
General Browne ..	Peshawur Valley	10,000 ..	38
„ Roberts ..	Kuram.....	5,550 ..	24
„ Biddulph ..	Quetta.....	6,250 ..	18
„ Stewart ....	Mooltan .....	7,300 ..	48

with a reserve—

General Maude ....	Hassan Abdul..	6,000
„ Primrose ..	Sukkur.....	6,000
Sikh Contingent .....		3,000

We will first follow the operations of the Peshawur Division, under General Sir S. Browne.

On Wednesday, the 20th November, the division camped at Jamrud, not far from the entrance of the Khyber Pass, which is a narrow defile commanded by the fort Ali Musjid, at its eastern mouth. The admirable sketches of Jamrud and Ali Musjid, by Captain Bartram, are more eloquent than any bald description that I may attempt.

On the evening of the 20th, a brigade under Brigadier-General Tytler was despatched with orders to make a flank movement to the right by a circuitous path, and to endeavour to get behind Ali Musjid at Kalla Kushta. Another brigade under General Macpherson also started at 2.30 A.M. along the same path taken by Tytler's Brigade, but turning sooner with a view of crowning the heights above Ali Musjid.

At 7 A.M. the General led the front attack, and by 11 A.M. the Sherghai heights were occupied by the infantry. At 1.30 the heavy

guns opened fire from this point, to which the enemy responded with accuracy. The infantry attack was now developed, and a general advance ordered. Our right soon became sharply engaged with the enemy's left, which held an inaccessible position. The enemy's right was also strongly entrenched, and our troops made no impression. Desultory fighting ensued until the evening, when, as nothing was seen of Macpherson's Brigade, the General decided to withdraw his troops, which retirement was effected with the loss of two Officers and several men; the British troops bivouacking on the positions they held.

At dawn it was found that the enemy had evacuated the fort. They had heard in the night of Tytler's arrival at Kalla Kushta, which caused a panic and precipitate flight. Many of the enemy were taken prisoners by General Tytler.

Macpherson's Brigade did not join the main body until the afternoon of the 22nd, the great distance and the almost insuperable difficulties of the road had delayed him.

The fort was found to have been strong, the outer works covering much ground, and to have assaulted it by front attack would have been an almost impossible task.

On the 23rd, the main body marched to Lundi Khana; on the 24th, to Dakka, where there was a halt for some three weeks.

On the 20th December the division entered Jalalabad, distant 41 miles from Dakka. General Maude's Division in the meantime had pushed up from Hassan Abdal and garrisoned Jamrud, Ali Musjid, and Lundi Khana.

Jalalabad is a paltry dilapidated town, in the form of a parallelogram, and about a mile in perimeter; the gates are hardly worthy of the name, and all those who have seen it must wonder all the more at Sale's heroic defence some forty years ago, when the ever-active Captain Broadfoot of the sappers and miners put this miserable place in a state of defence, and, in spite of earthquakes, kept an ever-formidable line of works confronting the enemy.

The Commanding Royal Engineer's hard work now commenced. Road-making, posts on line of communication, bridge-building across the Cabul River, drainage works, hutting troops, and various others of minor importance, all demanded his attention.

A trestle bridge in three lengths was erected in ten days across the Cabul River. A large fort near Jalalabad was put in hand. Road-making along the line of communication was systematically commenced, and this road-making before the end of the campaign assumed gigantic proportions. The most difficult portion was close to Ali Musjid, where the road had to be blasted out of the live rock for some two miles; a work that took many months to complete.

On the 30th April, 1879, the division advanced to Gundamuck, where a fort on a considerable scale was commenced. All the various engineering works above enumerated proceeded without intermission until the Treaty of Gundamuck. A telegraph line was laid from Dakka to Gundamuck, and a trestle bridge built across the Murke Kheyl Nullah, and on the retirement of the division from Safed Sung

in June some very successful rafting operations between Jalalabad and Dakka were carried out. The rafts consisted of inflated skins lashed together with a light framework, and between the 4th and 13th June 7,000 skins were used and nearly 1,000 tons of stores sent down the Cabul River. Besides this, 885 Officers and men were rafted down. The journey occupied about five hours; the distance being 40 miles.

From the commencement of the campaign, the Survey Department were fully employed surveying the country. In the Khyber, a systematic survey between Peshawur and Jalalabad was commenced.

By the 18th of June the retirement through the Khyber was completed.

After the advance to Jalalabad in December, the chief military operations were, with the exception of a few punitive raids—

Strengthening and securing advance posts.

Pushing supplies to the front.

Fortifying Jalalabad.

Massing reserve troops at eastern entrance of the Khyber.

Continuing reconnaissance and survey operations.

Improving and constructing main and supplementary roads.

Completing telegraph communication.

I need not remark that the different Commanding Royal Engineers were responsible for many of these operations.

Let us now turn to the Kuram Division, under the command of General Roberts, who was acting simultaneously with the Khyber columns.

By the appointed time, General Roberts's picked force of 5,000 men had concentrated at Thull, and on the morning of the 21st November, 1878, the division crossed a crib bridge which had been erected by the Commanding Royal Engineer, and marched up the valley, reaching Kuram Fort on the 25th without incident.

On the 27th, the division arrived at the base of the Peiwar Kotal. Here the enemy was found to hold a high range of pine-clad hills and precipitous cliffs, impregnable in front. His position extended for about 4 miles, facing due east, and his strength was estimated at 4,000 men with 24 guns.

The division halted on the 29th, 30th, and 1st December.

The General determined to turn this formidable position, and at nightfall on the 1st December the General, with 72nd, 5th Gorkhas, 29th Native Infantry, and a mountain battery, started on this adventurous attack, supported by two native infantry regiments, and 4 guns Royal Horse Artillery. The remainder of the division remained in camp, camp fires and tents left standing, and the utmost secrecy maintained.

The force wound its way up the bed of the torrent during the live-long night. There was nothing but the stars above and the deeply-shadowed hills on either side, and the everlasting boulder at your feet. Not a word was spoken, every sense was strained to the utmost; for no one knew when the fight might commence. On and on they

toiled, until at last at dawn, after nearly twelve hours' weary marching, our men found themselves at the foot of the lowest line of the enemy's breastworks.

The ever-gallant little Gourkas, supported by the 72nd, immediately assaulted the position. They were not to be denied, and over the breastwork they poured, bayoneting the Afghans. Three lines were taken in quick succession.

After three hours' fighting the enemy's left was rolled up. The reserves now arrived, and a desultory fight ensued until noon, when the General, with another turning movement, worked round the enemy's line of retreat.

In the meantime, the regiments left in camp worked up the front slopes, and this attack, together with the fact that their line of retreat was threatened, so disheartened the enemy that they retreated in haste, abandoning their guns and tent equipage.

Our troops, after nearly twenty-four hours' continuous marching and fighting, bivouacked on the field of battle at elevations varying from 6,000 to 9,000 feet. Fortunately there was plenty of firewood, so gigantic camp-fires soon lit up the pine-clad hills, and the exhausted Highlanders, Gourkas, and sepoys were quickly wrapped in the slumber so well earned after such a hard-fought day.

The General continued his advance, and on the 9th December reconnoitred the Shutur Garden, from which there was an extensive view, and which was found not to be so strong a position as the Peiwar. After which he returned to Kuram for winter quarters.

In a country like Afghanistan, when an advance is ended, the heavy work of the Royal Engineers begins.

The advance to the Shutur Garden had been so rapid that the Commanding Royal Engineer could do nothing more than hastily examine the country passed through. On returning to Kuram the following engineering works occupied his immediate attention:—

1. A line of communication from Thull to the Peiwar Kotal, crossing a river twice, to be first made practicable for camels and then for carts.
2. The Peiwar Kotal garrison to be well housed.
3. The zigzag road up to the Kotal to be laid out.
4. The old Afghan cantonment of Habib Killa made available for two regiments and one mountain battery.
5. The fort at Kuram strengthened.
6. Fortified posts to be built at selected spots on the road.

These important works took many months to complete, and with the exception of an expedition to Khost, no further military incident occurred until the news of Cavagnari's murder electrified India.

We will now turn to Southern Afghanistan. General Biddulph had, early in September, hurried on to Quetta to take command of the Quetta force already concentrating there, and on the 20th November crossed the frontier without opposition. General Stewart was, in the meantime, concentrating his division at Mooltan preparatory to his march of 400 miles to Candahar in the dead of winter, and through

a comparative desert. Naturally enough in England this march, because there was no fight at the end of it, received scant notice; yet, during the first phase of the war, it was the chief military incident. The fight at Ali Musjid, and the advance to Jalalabad; the advance to Kuram, and the hazardous fight on the Peiwar, neither can be compared in difficulty to this march. The Prussians noticed it; but the English public, who know but little of military matters, and who place a man who wins an ordinary skirmish on an absurd pinnacle of fame, took but scant notice of the General who marched an army rapidly for hundreds of miles through bitter cold and dismal waste, and, through his rapidity of movement alone, paralyzed the enemy and won his goal without a fight.

In November the division proceeded to Sukkur by the Indus Valley Railway, which, through the energy and foresight of the Public Works Member of Council, had just been completed at this opportune moment; and thence, in the latter days of November, commenced its arduous march to Candahar.

The country from Sukkur to Candahar can best be described as a melancholy waste, intersected by the Suleiman and Kojack ranges of mountains, and inhabited by a sparse population. As far as Dadur it is a dead flat, and beyond Jacobabad there is a desert 23 miles in width without a drop of water or a blade of grass.

Dadur is a miserable tumble-down place, and is at the foot of the Bolan Pass. From here the Candahar road leads for 60 miles through the Pass—a gradual ascent, the summit of which is reached some 20 miles from Quetta at an altitude of some 6,000 feet.

In winter there is not a blade of grass or a mouthful of food for man or beast for the whole of this 60-mile defile. The track in one march crosses the river fourteen times. There is nothing the weary traveller can see but the bare hill on either side, and the detestable shingle at his feet. The pass narrows as it reaches the summit, and the incline increases—the shingle becoming deeper and more fatiguing.

Quetta, after the weary pilgrimage from Sukkur, appears a very Garden of Eden. It is but a small oasis after all, green, well watered, with a few trees dotted about, but desperately cold in winter, the thermometer going down to zero. The Candahar road now leads through the Peshin Valley—a valley which can scarcely feed a single cavalry regiment; in which for three or four marches the troops drank brackish water; and which is almost entirely deserted by man or beast during the winter months. This for 60 miles until the base of the Kojack Range is reached.

The ascent from the east is easy, the descent into the Candahar Plain most precipitous. From the top of the Kojack Pass you see the Candahar waste in front of you, bounded on your left by the far-reaching Seistan desert, whose red sands billow until lost in the distant horizon. To your front and to your right this stony waste is intersected by Doré-like looking hills, fantastic and weird, as if high seas of molten rock had surged through the plain and been suddenly arrested, and this for 70 miles until from a hill overlooking Candahar,

your eye at last rests on a smiling valley some miles in extent, with embattled Candahar nestling in its midst. Such was the country through which the General had to march some 14,000 men, including followers, and 7,000 camels.

I have not time to give any details of the march. The hardships commenced in the Bolan, where the camels died in hundreds, and the bullocks dragging the heavy batteries had their feet actually torn off, the escort finally manning the heavy guns and dragging them up the pass. By the end of December, the two divisions had concentrated at the foot of the Kojack. A road and gun-slide were there prepared by the engineers.

On the 4th January, 1879, the cavalry brigade, under General Palliser, met a small body of the enemy at Tukht-i-Pul, 30 miles from Candahar, and on the 8th General Stewart entered Candahar and encamped on the north-east of the town. The goal had been won almost without a blow; rapidity of movement had been a more deadly weapon than the breech-loader.

Four hundred miles had been covered in six weeks. The intense cold, the want of forage and clothing, had killed the camels with frightful rapidity. The cold and dearth of supplies were far more deadly enemies to the General than the Afghan; the divisions threatened to be no longer divisions in consequence of loss of mobility, and the General saw that any delay would be fatal to him. He could not afford to give rest to the weary animals, and therefore pushed on day after day. Much has been talked about the loss of camels in this campaign, but if a Government insists in declaring war in the dead of winter, and in dispatching an army over mountainous ranges and desolate wastes with cold and famine staring them in the face, can they expect aught else? General Stewart carried out their orders to the letter. He took Candahar at the expense of some thousands of camels. Some Generals would never have got there that winter.

After a week's halt General Stewart, after leaving a strong garrison at Candahar, marched to Khelat-i-Ghilzai, distant 84 miles, General Biddulph marching to Geriskh. In February both Generals returned, and shortly afterwards, in March, General Biddulph returned to India with his division by the Tull-Chotiali route.

On arriving at Candahar, the Commanding Royal Engineer immediately found his hands full to overflowing—a cantonment had to be built, and various works, such as water supply, drainage, road making, commenced. These works proceeded without intermission until July, when the cantonment was finished, and the troops comfortably housed. In consequence of the paucity of timber at Candahar, nearly all the roofs are domed, the villages at a distance looking like beehives. The rapidity and ingenuity with which the Candahar mason builds these domes is most remarkable. They use gypsum, a quick-setting cement, and work independently of centering. Our head native foreman had, odd to relate, built barracks for General Nott, some 40 years ago. In the Bolan, too, road making on a large scale was being pushed on, and a detailed survey of the Peshin and Candahar districts was being completed.

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Ill-fated Cavagnari and the whole of his mission, with the exception of a few sepoy who escaped, were murdered at Cabul on the 3rd September, 1880. News reached Simla on the 15th, and General Roberts, who happened to be there, rushed down to the Kuram and commenced organizing a force for an advance on Cabul. The General had one great difficulty to contend with, viz., the almost absolute dearth of transport. The first phase of the campaign had nearly drained the whole of Upper India of camels, and armies in the field were now no longer armies owing to their inability to move.

Everybody's energy was devoted to the burning question of transport. The transport department purchased anything with four legs at enormous rates, and by the 24th an advance across the Shutur Garden was made. The guns were carried on elephants, the native cavalry carrying most of the baggage on their own chargers, the troopers walking, and the remainder of the baggage coming on an incongruous train of mules, ragged ponies, and donkeys—donkeys predominating. By the 5th, the division, consisting of 2,510 British, 3,186 natives, 1,200 horses, reached Charasiab. This had only been effected by working the wretched transport animals almost to death, for they had to make return journeys.

Here it was that the enemy, who had been watching our advance with ever-increasing numbers, had decided to make a stand. By turning to the map you will see that a range of heights commands the road to Cabul. The enemy's position was horse-shoe in shape, with a front of from 2 to 3 miles, consisting of rows of hills rising one above the other. In the centre, the enemy held a strongly entrenched position, his right was thrown forward and rested on rugged peaks from 1,000 to 1,800 feet above the plain, his left held the Sung-i-Nawishta defile. General Baker, who was entrusted with the attack on the morning of the 6th, ordered Major White with a mixed force to threaten the Sung-i-Nawishta defile, the remainder of the force making the real attack on the enemy's right.

White advanced as ordered, making as much display of force as possible. By noon the 72nd and Gourkas had carried the left ridge, and again advancing at a double, carried the second ridge, driving the enemy back on to the main ridge.

Major White now joined hands with the left, and the whole force making a simultaneous advance carried the main ridge at 4 o'clock, with the loss of a few men, the enemy breaking and flying towards Cabul. Our losses were small, though the position held by the enemy was rugged heights some 1,800 feet above the plain, and this is a striking example of the fact that a rugged height is not necessarily a strong position. Height, without command of the slopes before you, is an advantage more moral than real. The attacking force when once ascending the slopes are unseen, while the defenders, if they show at all, stand out clear on the sky-line.

On the 8th, Sherpur was entered by our cavalry, and on the 9th, the whole force encamped on the Siah Sang plateau, overlooking Cabul, and the most dashing march in the campaign was crowned with complete success.

The General had great difficulties to face. Want of transport at starting threatened to cripple him, but the loyal working of all overcame this. He had but a precarious line of communications behind him, and had an ever-increasing enemy in front of him; but his rapid advance and hard hitting effectually crushed the enemy. Had General Roberts but been allowed to burn down Cabul and then retire, he would have left a monument over Cavagnari's grave which centuries would not have effaced.

And now again, as ever must be the case in warfare of this description, the General's chief care was to procure supplies and to provide shelter for his troops. The Royal Engineer staff found their time fully employed. The Sherpur camp was repaired; the Bala Hissar was ransacked, cleared of all powder and other ammunition, and made fit for human habitation; sheds for horses, for commissariat stores, roads, and bridges were commenced. The works continued without intermission until the first week in December, when the whole country rose in arms and attempted to drive the hated Englishman from Cabul.

We will now turn to the Khyber Division, under General Bright, which had been ordered to advance. This division, too, was almost paralyzed by the dearth of transport. The roads, bridges, and posts required extensive repairs.

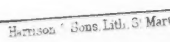
On the 2nd November, General Gough, with a force of 1,900 men with seven days' supplies, advanced as far as Jugdalluck, where he was met by General Macpherson from Cabul, and by the 19th November telegraphic communication between Cabul and India was established and a rough line of communication opened. The road which had been completed as far as Gundamuck, was now pushed forward into the Jugdalluck range of mountains, and this stupendous work, which took months to complete, was commenced by Major Blair, R.E.

Nothing of any incident had happened in Southern Afghanistan, excepting the advance of a brigade beyond Khelat-i-Ghilzai and a small fight at Chagnui.

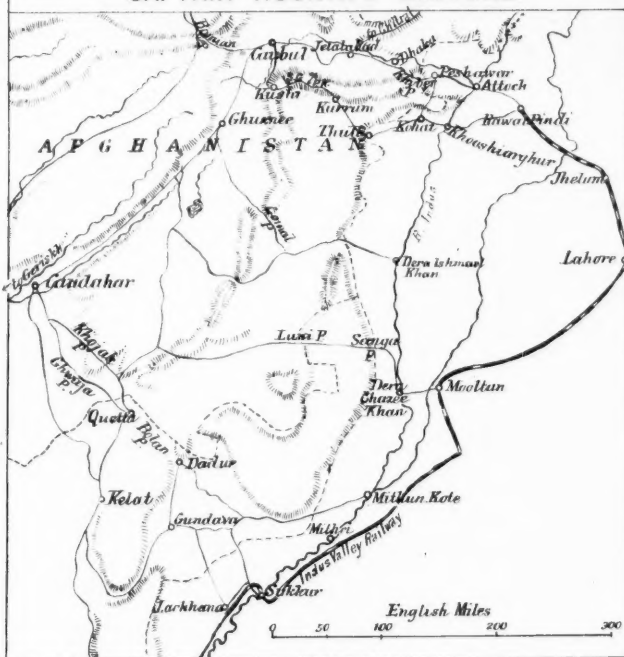
During the early days of December it was evident that disaffection amongst the tribes round Cabul was increasing, and General Roberts considered it necessary to detach brigades, under Macpherson and Baker, who were to march into the disaffected districts and engage the enemy. In Sherpur a small force was left to garrison the cantonment.

I have no time to relate the fighting that took place on the 10th, 11th, 12th, 13th, and 14th December. Suffice it to state that on the evening of the 14th our force was driven into Sherpur cantonments by enormous masses of the enemy, roughly estimated at 60,000. The British force had been within an ace of a great disaster, and by good luck had escaped a beating in detail. The prospect of loot in Cabul turned the Afghan's attention from Sherpur, which he might have assaulted with every chance of success. Entrenchments were hastily commenced in Sherpur. Owing to the enormous extent of the cantonment, over 4 miles in perimeter, only one-half of which was con-





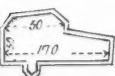
SKETCH MAP  
TO ILLUSTRATE  
CAPTAIN HOSKYN'S LECTURE.



SKETCH  
SHOWING THE DEFENCES OF KABUL AND ITS VICINITY,  
ERECTED BY THE BRITISH FORCES DURING THE OCCUPATION OF 1879-80.

REFERENCE

③ Tower for 30 Rifles (Bala boori).

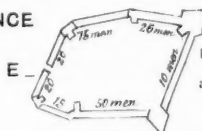


Block House for 2 Companies.

⑫ Tower for 10 Rifles.



Block House for 30 Rifles.



Fort for 1 Battalion Infantry  
and 5 Guns. Enplacements.

F. — Tower for 30 Rifles.

G. — Fort Ibrahim Khan for 1 Battalion of Infantry.

H. — Redoubt for 2 Companies.

Scale of Yards.  
0 500 1,000 2,000 3,000



tained by a wall, every available man in the division helped to swell the working parties.

The Commanding Royal Engineer immediately put in hand the scheme already prepared in November. The northern face, the key of the cantonment, the Bamaru heights which had already been strengthened by some towers, was still further fortified by a line of breastworks, with emplacements for guns at certain intervals. The north-west face was defended by a ditch and breastwork of ammunition-waggons, abattis, and wire entanglements (Pl. IX).

The eastern face, the weakest, was defended by detached buildings, and Bamaru village was loopholed. Garden walls and villages dangerously near the cantonment were blown down and levelled. It was considered necessary to clear completely 800 yards all round the cantonment inclosure. The fruit-trees felled made abattis, and all shelter for the enemy was razed, the walls were loopholed and breastworks strengthened; strong abattis were made along the south face and the incomplete flanks, and a second line of defence within the enclosure commenced. A week and General Roberts received news that Gough, with a small force, was advancing from Jugdalluck, and that the enemy contemplated an attack, which took place on the 22nd, was easily repulsed, and our troops again acted on the defensive. On the 24th the enemy dispersed, and Gough also arrived from Luttahund, after perhaps the most hazardous march in the campaign; for he had, with 1,100 men, marched for 50 miles through a country swarming with the enemy, who, marvellous to relate, did not molest them on the road. Had Mahomed Jan been able to control his robber army, he could have utterly annihilated Gough in the Jugdalluck defiles. The loot of Cabul had been as dangerous an enemy to Mahomed Jan as the British bayonets. It had lost him a golden opportunity of seizing Sherpur on the 14th, and also the comparatively easy task of beating back a small force, painfully toiling through the Jugdalluck Mountains. The most remarkable feature of the December fighting was the fact that the enemy never seriously attacked the Khyber line of communications. The enemy had disappeared as suddenly as they had appeared. The year closed quietly. The whole of the posts along the Khyber line were re-occupied and the telegraph line repaired.

In order to prevent a similar occurrence it was necessary to fortify the Cabul basin rapidly and strongly. The Commanding Royal Engineer, Colonel Perkins, R.E., commenced a scheme which had already been prepared. Fort Roberts, with two detached works, was commenced on the Siah Sung range. The Bala Hissar was cleared, strengthened, and occupied by the Khyber Brigade. Forts and detached works were commenced on the Asmai and Darwaza heights. Two native forts on either flank of the defile were placed in a state of defence, the Sherpur cantonment was made a formidable entrenched camp, bridges in three places were built over the Cabul River, a circular artillery road was made round the cantonment, and all main roads leading into the neighbouring valleys were repaired for the passage of artillery. The post at Budkak was fortified and a post and

entrenched camp at Luttabund was commenced. In all, the Commanding Royal Engineer at Cabul had under his direction the following works to complete:—10 forts, 15 detached works, 3 large trestle-bridges, numerous small ones, 4,000 yards of defence, 45 miles of road, 2 posts, also quarters for 8,000 men, followers, and baggage animals. The works I have detailed proceeded without intermission until June.

The Commanding Royal Engineer on the Khyber line was also carrying out similar works, the most difficult and important being the construction of the road through the Jugdalluck range of mountains. This road, which was completed in May, cost roughly about 300% per mile, and was executed almost entirely by task-work and local labour. The list of posts and étappen troops under General Bright give some idea of the difficulty and expense of maintaining a line of communication between Cabul and Peshawur.

In Southern Afghanistan quiet had reigned at Candahar. The Sukkur-Sibi Railway was being rapidly pushed on, and surveys for the best railway route were progressing. This railway is chiefly noticeable for the rapidity with which it was laid—133 miles in 126 days. Certainly the country was a dead flat, but the Chief Engineer had to contend, in a minor degree, with the same difficulties that M. Lesseps encountered in the Suez Canal—he had to provide food, shelter, and water for the labourers, who were imported from South India.

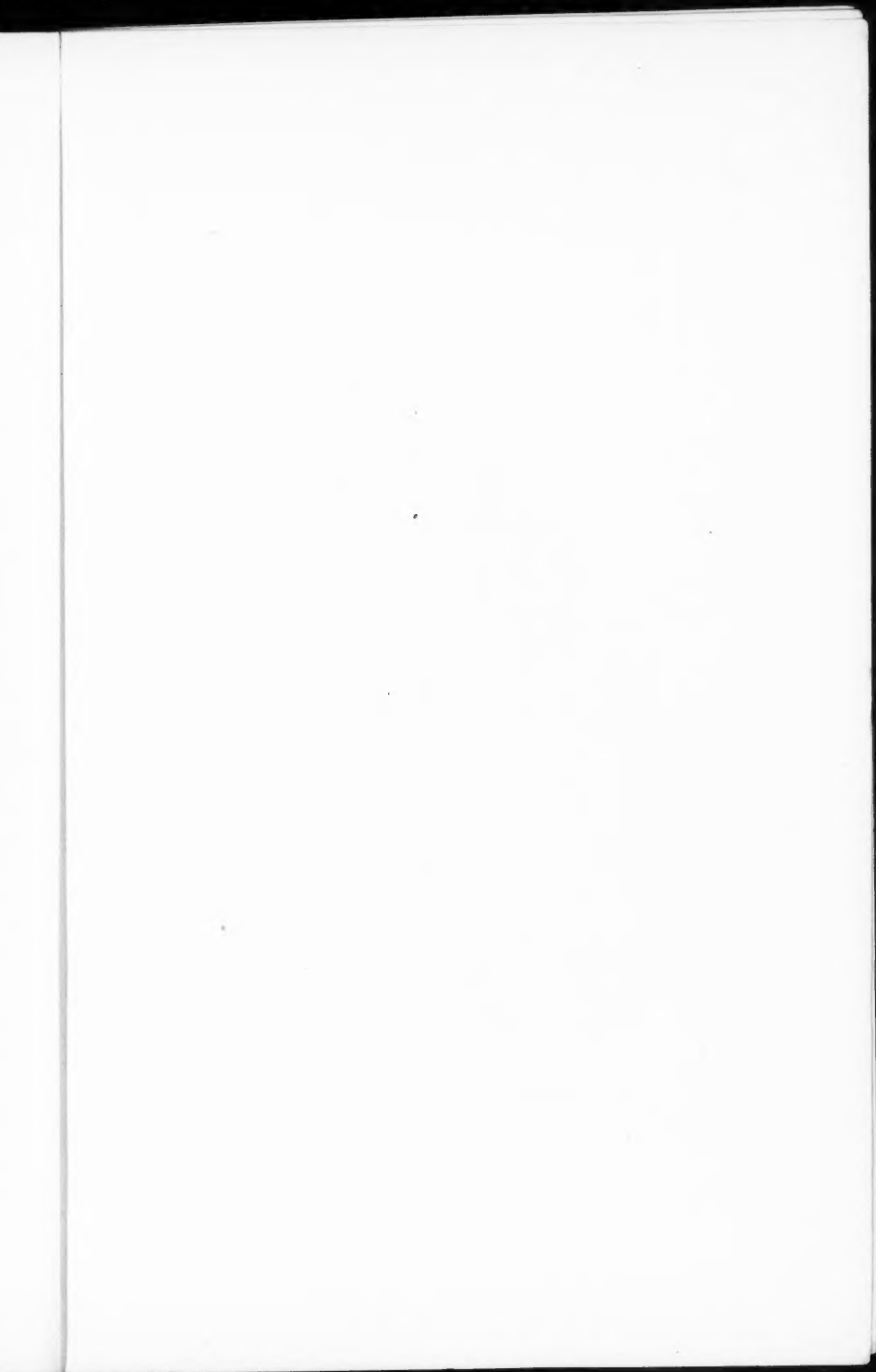
Bombay troops were advancing to Candahar to relieve General Stewart, who, with his whole division, was to march on Ghazni. The orders under which General Stewart marched were as follows:—“General Stewart must break up opposition at Ghazni, and then open communication with Cabul, which place or Kuram may ultimately become his base, according to circumstances. Ghazni is not to be held for any time, and as it is desirable that the whole of the operations in Afghanistan be under one head, he must assume command as soon as he shall have opened communication with Cabul.”

By the end of March, the Bengal Division had been replaced by the Bombay Division under General Primrose, and on the 31st the division, numbering 7,193 fighting men, commenced its march to Ghazni, distant 227 miles. The brigades were as follows:—

Cavalry Brigade.....	General Palliser, 3 native regiments.
1st Infantry Brigade..	General Hughes, 59th and 2nd N.I.
2nd                    ,,       ..	General Barter, 2   60th and 2nd N.I.
R.A.....	A   B R.H.A., G   4 R.A., 11   11 R.A., and 6   11 R.A., heavy battery.
R.E.....	2 companies sappers and miners and field park.

At first, the division marched in detached brigades, Palliser one march ahead of Hughes and Barter, on the right of the valley, distant some miles, but, after a few days, in heliographic communication.

The country through which the advancing force marched was an ever-rising valley, several miles in width, with a river running down its centre, and with fortified villages dotted about, a few trees occa-



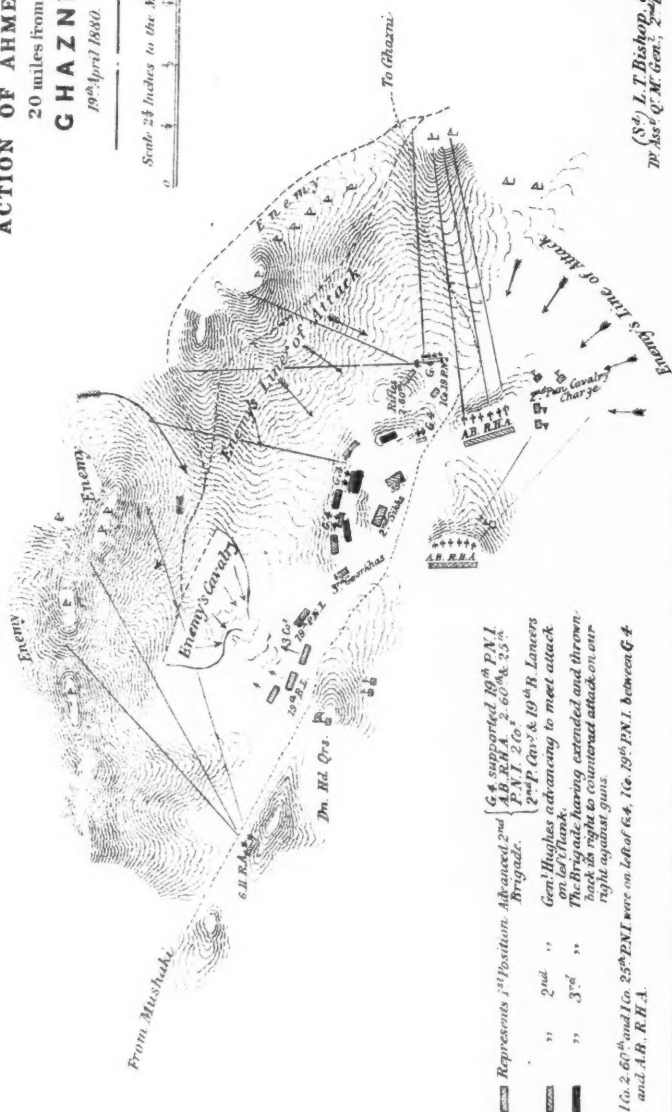
**20 miles from**

## GAZNI.

19<sup>th</sup> April 1880.

Scale  $\frac{2\frac{1}{2}}$  Inches to the Mile.

Lyons



(S<sup>d</sup>) L. T. Bishop, Captain,  
W. Ass<sup>t</sup> Q. M. Gen., 2<sup>d</sup> Brigade.

—4000— U. S. 5285, 2114, 51 MAR 27, 1961 J.N.C.

sionally fringing the rugged banks of the river. On the 8th, Khelat-i-Ghilzai was reached, the strongest fort in the country, an isolated hill, with a remarkable supply of water bubbling up in its midst.

The march proceeded without intermission. From continued practice, the rapidity with which camp was struck, and animals loaded, was remarkable. Rouse at 3; march at 4. The moment *réveille* sounded, the whole camp, which had been wrapped in complete silence, broken only by the occasional challenge of a sentry, sprang into life. The universal tapping of tent-pegs mingled with the noisy remonstrances of the camel, angry at being laden. The camp fires, with a few dark figures crouched round them, threw out into relief the string of laden animals silently taking up their position on the line of march. At the appointed time, the troops moved off in column of route, so quietly—one might say so stealthily—that one scarcely knew when the march commenced. It was some hours, however, before the last camel left the camping ground, for the country did not offer an open front to the baggage, which was often in one line several miles in length, and travelling about two miles an hour; camels cannot go faster.

On arriving at the new ground, which had previously been marked out by the Deputy Assistant Quartermaster-General, foraging parties were sent out with all available mules; these parties having to go many miles to villages, and not returning sometimes until the evening, and then sometimes almost empty handed.

On the 14th, General Barter joined hands. The country was now totally deserted by man and beast. The whole population had decamped and helped to swell the ever-increasing force, which were seen marching parallel to us on our right. This continued until the 17th, supplies being collected with the greatest difficulty. On the 17th, the leading brigades halted, and in the evening the whole division was concentrated. On the 18th, after a march of 200 miles, the enemy was observed to occupy a group of villages some 3 miles east of camp. On the 19th, the division marched in the following order:—

1. General Palliser's Brigade—6 guns; 380 sabres; 698 rifles.
  2. General Hughes's Brigade—10 guns; 349 sabres; 1,092 rifles.
  3. Baggage.
- Rear Guard—General Barter—6 guns; 316 sabres; 1,393 rifles.

The length of the entire column was some 6 miles. After marching about 7 miles, the enemy was seen in position 3 miles in advance of the column. Hughes' Brigade advanced on the left of the road in line with the Royal Horse Artillery, until within some 2,000 yards of the enemy's position.

At 9, the position was as shown in the sketch of battle-field, Barter in the meanwhile having been ordered to send up half his infantry (Pl. X). As General Hughes occupied some favourable ground in front of him, the enemy, which swarmed on the heights, advanced to the attack at a swinging walk. In a moment, our position seemed to be enveloped. Standard bearers, surrounded by their followers, advanced in line. Nothing daunted them, though mown down in scores, the deadly effect

of infantry fire seemed to have no moral effect; they walked right up to the guns, and up to the British bayonet. Our 19th Bengal Lancers were charged by the enemy's cavalry and driven right back into the Head Quarter Staff; the General himself having to draw his sword. The Gourkas formed rallying square, and every man of the reserves, viz., two companies sappers and miners, and a wing of the 19th Native Infantry, reinforced the left.

The enemy continuing to advance, A | B Royal Horse Artillery had to retire to a position 200 yards to the rear, the line conforming to this movement.

The attack only ceased when the Ghazis had been either killed or wounded, for the great mass of the enemy did not join in the fight, but awaited the result of the first onslaught, in which the Ghazis showed such prodigies of valour, and such a dauntless front, that at one time, *i.e.*, when our guns were forced to retire, our position was critical. Fortunately the first rush was not supported, and by 10 A.M. the action was won, and the enemy streamed away over the hills, leaving some 1,200 dead on the field.

To give some idea of the close fighting, the Royal Horse Artillery fired all their case, finishing up with inverted shell; the average range being under 200 yards.

The question that arises in considering the tactics of this action is, was not the sudden attack of the enemy the best for us? We received their attack in something approaching a line. Had we attacked their position, as we most undoubtedly should have, there is but little doubt but that the attack would have been carried out in the loose formation as at present taught. Now the *raison d'être* of loose formation is the assumption that there is such a deadly fire in front of you, that an advance in close formation is an impossibility. This is a *pis aller* at the best. Take away this crushing fire, and place in its stead overwhelming numbers of a superbly brave and fanatical enemy, and it appears that the old formation so dear to British arms is best suited to warfare of this description.

The division, after an hour's halt, to bury the dead, recommenced its march, 17 miles, reaching Nani in the evening. On the following day, 21st, a reconnoitring force, under Major Lance, entered the famous Cabul Gate, and marched through the town of Ghazni, the first Englishman to enter it for forty years.

Ghazni itself is a most dilapidated town, and the whole place may be considered unimportant as a fortress (Pl. XI).

The division halted three days at Ghazni, during which halt a force under General Palliser was sent out to dislodge the enemy from some villages, distant 5 miles. This was effected, but not until reinforcements had come up, and General Stewart himself took command.

On the 25th, the division marched towards Cabul, and on the 28th, General Stewart, who had commanded the division for 16 months, left to take supreme command at Cabul, the division remaining in the Logar Valley for summer quarters, where we must leave them, and turn to Southern Afghanistan, for there in July a terrible catastrophe had taken place, and our troops were besieged in Candahar.

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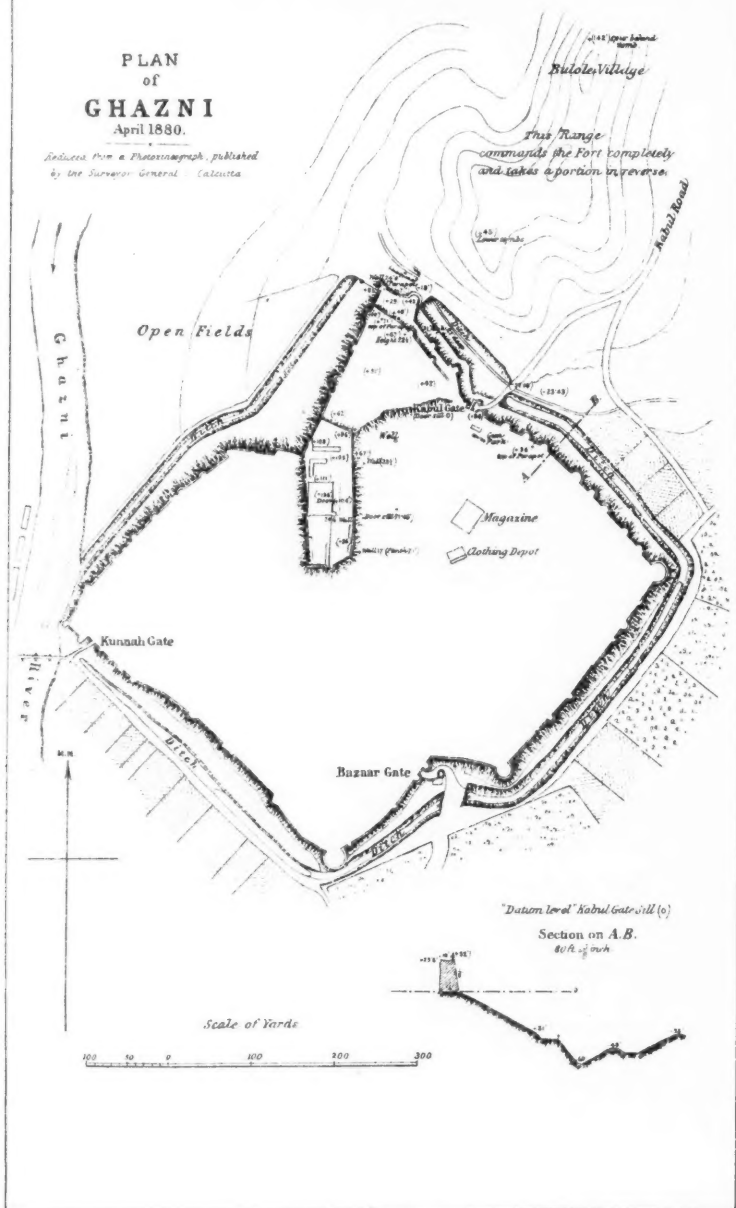
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PLAN  
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**GHAZNI**  
April 1880.

Reduced from a Photograph, published  
by the Surveyor General, Calcutta.



After the departure of the Bengal Division for Ghazni, matters remained comparatively quiet in Southern Afghanistan, during the months of April and May. There were, however, signs of coming trouble from Herat.

In June, Major Leach, R.E., visited Maiwand, with the express purpose of reporting whether it afforded a good position for a standing camp in case of necessity.

On his return, Major Leach reported that strategically it was important, owing to its command of roads from north and west, and that there was abundant water and supplies.

On the 31st, the Wali marched at the head of a Candahari force for Geriskh. News now came from Herat that Ayub was on his way to Candahar. About the 15th July, the Wali wrote from the Helmund asking for money, and entreating for aid in the shape of a British brigade.

On the 6th July, news came that Ayub had reached Furrak, about 160 miles from Geriskh. This advance produced much excitement in the town and country, and preparations were finally made to march a brigade to the help of the Wali.

On the 2nd July, Brigadier-General Burrows, in command of the following brigade, started:—

E. B. R.H.A., 66th Regiment, 6 companies; 3rd B.L., 3 Scinde Horse; 20 sappers; 1st and 30th Bombay Native Infantry—in all, 2,300 men.

On the 11th, Burrows reached the Helmund only to find that the Wali's troops were in a state of mutiny, and that the Helmund River could be forded anywhere.

On the 14th, the Wali's troops deserted *en masse*, taking with them six guns, which were eventually recovered by our troops after some fighting. On the 18th, Burrows retired his brigade to Khusk-i-Nakud; this position being in easy communication with Candahar. On the 18th, Ayub's cavalry entered Geriskh. Between the 18th and 26th, Burrows remained at Khusk-i-Nakud; his cavalry daily patrolling the country, but in such a perfunctory manner, that no information was brought in, and on the 26th, Burrows heard for the first time that the enemy's cavalry had entered Maiwand.

Now Burrows's orders were to stop Ayub from slipping past him on the Ghazni road, and therefore on the morning of the 27th he struck camp and marched for Maiwand. On arriving at Mundabad he found himself confronted by the enemy in strength, and advanced to meet them, taking up the position as shown in this sketch-map of the battle-field.

By 11.30, the enemy concentrated an artillery fire of thirty guns on the British position, who submitted to an artillery pounding until 2 P.M., in which the cavalry suffered severely. A pause now ensued—a lull before the storm—when dense masses of Ghazis attacked the centre and left of our position. The 30th Native Infantry gave way and the whole of our left rolled back, a disorganized mass, and the 66th Foot, now exposed by the collapse of the left and hampered by the beaten throng, began to retire towards the village of Khig. As a

forlorn hope, the cavalry were ordered to charge. The men, however, shaken by two hours' passive exposure to artillery fire, answered in only a half-hearted manner, and charged but feebly, after which they wheeled about and retired. The British force was utterly beaten, and fugitives spread over the plain on the way back to Candahar.

The first news of this disaster reached Candahar on the 28th. General Brooke hurried out with a force to help the fugitives in. The Commanding Royal Engineer was ordered to make all preparations for a siege, and the cantonments were evacuated and the whole force withdrawn inside the city walls, which were over 3 miles in perimeter, the walls being of solid sun-dried masonry, some 30 feet in height and 15 feet thick, the only available flanking fire coming from small circular bastions in a very dilapidated condition.

The Commanding Royal Engineer immediately closed the gates and commenced destroying all houses abutting on the walls. His whole staff consisted of 4 Officers, 5 non-commissioned officers, and 40 sappers, with bad equipment and scarcity of tools, the hurried retreat into the citadel from the cantonment not giving time even for the carriage of tools from the engineer quarters into the citadel. The strength of the besieged force was 4,600 men, 13 guns, 2 mortars; supplies were plentiful.

The working parties toiled without cessation at the ramparts, making ramps, gun-platforms, and traverses. The guns were mounted on the different emplacements as soon as ready. Up to the 16th August but little of incident occurred, with the exception of a sortie on the west, in which Lieutenants Waller and Jones, R.E., particularly distinguished themselves.

On the twentieth day of the siege the enemy had invested the town and held a strong position in the village of Deh Khoja. The General decided on making a sortie on this village, and on the morning of the 16th a force consisting of 800 rifles and 300 sabres issued from the Cabul Gate. It was divided into three portions, each with an engineer officer, a few sappers, some powder-bags and tools.

On arrival at the village it was found that every door was barricaded, every wall loopholed, and nothing could be done but to attempt to seize some houses in rear of the village. This was attempted, but masses of the enemy now arrived from other villages and attacked our men in the open, who, finding themselves under a cross-fire, were forced to retire into the city, losing heavily, General Brooke and Captain Cruikshank, R.E., being amongst the number. The result of this sortie was to still more depress the garrison, but fortunately the rumours of succour now spread, which rumours became a certainty when, on the 24th, the investment was abandoned and Ayub commenced to take up his position in rear of the Baba-Wali range, and there entrench himself.

The cause of this sudden move was the fact that General Roberts had arrived at Khelat-i-Ghilzai.

I must now ask you to return with me to Cabul. During the months of May, June, and July the forces in Northern Afghanistan

were comparatively inactive. The fortification of Cabul was completed and the line of communication to Peshawur perfected, a splendid road, 200 miles in length, and fit to drive a coach and four along, having been engineered over a most difficult and mountainous country. Preparation had been made by General Stewart for the withdrawal of all the forces from Cabul early in August. The orders for the march were on the point of appearing, when the whole army was struck dumb with the news of the disastrous defeat at Maiwand and the investment of Candahar. It was ever a war of surprises, and South Afghanistan had to be reconquered. General Stewart immediately ordered General Roberts, at the head of a picked force, to march to the relief of Candahar. The best troops, the best carriage, consisting of mules alone, were placed at his disposal. He was not to take any field artillery, as wheels might delay him, and because it was known that there was artillery in Candahar.

On the 8th August General Roberts, at the head of the very best force the Indian Empire could provide, started on this memorable march, the rest of the troops retiring from Cabul towards Peshawur.

His force was as follows:—

1st Brigade ....	General Macpherson, 92nd, 2nd Gourkas, 23rd, 24th N.I.
2nd Brigade ...	General Baker, 72nd, 5th Gourkas, 2nd, 3rd Sikhs.
3rd Brigade....	General Macgregor, 2   60th, 15th Sikhs, 4th Gourkas, 28th N.I.
Cavalry.....	Brigadier-General Gough, 9th Lancers, 3rd B.C., 3rd P.C.
R.A. ....	Colonel Johnson, 6   8 R.A., 11   9 R.A., No. 2 M.B., all mountain guns.

He had 10,000 fighting men, 18 mountain guns, and 8,000 followers. He had admirable transport. His Chief of the Staff, Lieutenant-Colonel Chapman, R.A., knew the road intimately, as he had just marched up with General Stewart. The time of year was also fortuitous, as the harvest had lately been gathered and supplies were ample on the road.

It is unnecessary to give a detailed account of the march, as that has already been given here by Colonel Chapman.<sup>1</sup> Suffice it to state that Ghazni was reached in seven days, 98 miles distant, *i.e.*, at the rate of 14 miles a day. Khelat-i-Ghilzai, 136 miles from Ghazni was reached in eight days from Ghazni, giving a distance of 17 miles per day, or an average of  $15\frac{2}{3}$  miles for fifteen days without a single halt. From Khelat-i-Ghilzai to Candahar, some 80 miles distant, the force advanced by ordinary stages and reached the latter place on the morning of the 31st, having covered 321 miles in twenty-three days, or a total average of 14 miles a day.

The principal point of interest in this march was the remarkable endurance shown by the infantry, which, after arduous marches, had to furnish foraging parties, and which, when on rear-guard, was several

<sup>1</sup> See Journal, vol. xxv, No. CX.

times sixteen to seventeen hours *en route*, and had again to rouse at 2 A.M. for a fresh start. This march showed that General Roberts commanded a division of hardy soldiers, admirably equipped with mule transport, the backbone of their mobility, and it showed that, after eighteen months' campaigning, we had at last worked out a good system of transport, and that now at the close of the campaign—which is so often the case with British forces—we had indeed, by dint of trial, error, and expensive lessons, produced a division that no army need be ashamed of.

The British public believe that this march was the most brilliant feature in the campaign. The whole nation was watching the advance with rapt attention and bated breath, and a pæan of praise rang out through the whole length and breadth of England when the news of the relief of Candahar arrived; but, after calm reflection, does not the military critic come to the conclusion that the advance to Cabul over the Shutur Garden was perhaps a more difficult achievement?

General Roberts there had the initiative entirely in his own hands. Want of transport almost crippled him at starting, but by dint of energy and dash he overcame all difficulties, and, fighting a general action at Charasiab, entered Cabul one month after the murder of Cavagnari. And, again, in what particular does the march from Cabul to Candahar exceed in difficulty that of General Stewart from Candahar to Cabul? General Roberts had not a wheel in his division and left Cabul without a single camel, marching with great rapidity and without opposition to Candahar, where he beat Ayub Khan and raised the siege.

General Stewart left Candahar for Ghazni with a heavy battery, one battery Royal Horse Artillery, one battery Field Artillery, the road having to be repaired on the way for the artillery. The country was more or less unknown to him; he had camel carriage, elephants, and bullocks; for some 60 miles the villages were absolutely deserted, and the difficulty of getting supplies great. He fought a general action at Ahmed Kheyl, and on the twentieth day from Candahar took Ghazni. I would ask military critics in what particulars the march to Candahar from Cabul was *per se* a more brilliant operation than that of General Stewart's to Ghazni? It is easy to understand why the British public think so. The General Election absorbed the attention of the British public during General Stewart's march. General Roberts was more fortunate: he had the eyes of the world turned on him. The disaster at Maiwand and the siege of Candahar had tarnished the honour of the British flag, and the rapid and completely successful way in which this stain was wiped off on the 1st September was received with acclamation by the whole British nation.

But to return to the narrative. No sooner had the General arrived at Candahar than a reconnaissance in force was sent out in the afternoon of the 31st, which forced the enemy to show his position, and before daylight the General had matured his plans, which was to threaten the enemy's centre and left (Baba Wali Kotal) and to attack in force the enemy's right by the village of Pir Paimal.

At the appointed time the Cabul division was in position ready to attack the enemy's right by the village of Pir Paimal. The troops under General Primrose held the position during the day, as shown in this map;<sup>1</sup> threatening the left of the enemy at Baba Wali, and protecting the right flank of General Roberts's force. The cavalry, under General Gough, formed in the rear of the left, with two days' provisions. At 9 A.M. the 40-pounders opened fire on Baba Wali, and the 1st and 2nd Brigades attacked Gunda and Gandigan simultaneously, which were carried after stubborn fighting, in which the 72nd lost heavily. The two brigades now advanced along the canals, the 1st carrying the village of Pir Paimal on the right, and the 2nd the woods and orchards in front of them. At noon the 3rd Brigade was ordered to advance to the support of General Ross.

In the meantime Major White of the 92nd, who had taken Pir Paimal, found himself confronted by ever-increasing masses of the enemy, but nothing daunted by their number, the 92nd and Gourkas dashed into the heart of the enemy, capturing two guns. The enemy was stunned and utterly broken by this daring attack, and retired rapidly towards the river. The 2nd Brigade, who were advancing on a collateral line, cleared the portion in front of them and took three guns behind the northern hill. The enemy were defeated on all sides, and hastily fled, leaving guns, tent equipage, and ammunition. The glory of the day was marred by the treacherous murder of poor Maclean, who had been taken prisoner at Maiwand. The number engaged were—

8,392 of all ranks, 18 guns—Cabul force.

4,110 men—Candahar force.

I have no time to follow General Macgregor's march through the Murree country, which march, though little has been heard of it, was admirably managed and displayed high strategical ability. General Macgregor himself wrote: "The country was most difficult; on two occasions the troops were out twenty-four hours, and once for thirty-six hours. Some of the regiments have been continuously marching ever since they left Cabul, having covered 1,060 miles in 109 days." Nor can I say more with reference to General Phayre's advance from the Kojack Pass than that he arrived too late to join in the relief of Candahar. He could not help this, for he was given an almost impossible problem to solve. He was ordered to concentrate his division, which was scattered along the line from Dadur to the Kojack; to collect a month's supply for General Roberts; and to march immediately on Candahar. But, alas, the old, old story again repeated itself—he had not sufficient transport, nor had he anywhere to turn for more.

The points of interest and the lessons we gain from this campaign appear to be as follows:—

#### I. *The Heliograph.*

The heliograph was used for the first time systematically, and

<sup>1</sup> Colonel Chapman, see *ante*, gives an account of this battle.

proved of extraordinary value. On occasions, messages were sent from Cabul to Jamrud, distant 190 miles, with only four intermediate stations. Again, during the investment of Sherpur, the permanent telegraph line between Cabul and Gundamuck being destroyed, signalling between the above-named places, 75 miles distant, was accomplished through one intermediate station at Luttabund: (2) its remarkable power of penetrating haze or cloud; (3) its extreme value during an action.

General Scobelev, in the late Tekke Turkoman Campaign, on reading of the triumph of the heliograph in the Afghan Campaign, immediately ordered some instruments, and organized a signalling corps.

## II. *Military Engineering.*

This campaign has proved without doubt the absolute necessity of keeping up in India a large body of Royal Engineer Officers available for military duty at any moment. The engineering works which I will enumerate will show you how important a share in the campaign the engineer took. On all the lines the communications had to be made, in some places, one might say, hewn out of the live rock, and the magnitude of the works will be better realized when I inform you that at the end of the campaign 117 Royal Engineer Officers had been employed in different parts of Afghanistan.

A magnificent road was engineered between Cabul and Peshawur, 200 miles in length, over a mountainous and wild country, where labour was most difficult to procure.

A road was engineered between the Shutur Garden and Thull, 100 miles, through mountainous country.

A road was made through the Bolan Pass, 80 miles.

A road was made over the Kojack Pass, 20 miles.

In all some 400 miles of road, or as far as from here to Edinburgh, round and over mountains, to which our boasted Helvellyn is but a pigmy.

The railway to Dadur from Sukkur, 123 miles, was laid.

Some forty posts on different lines of communications, with their endless barracks, sheds, storeyards, &c., were built.

Various trestle and pile bridges were built, and hundreds of miles of telegraph lines were laid.

Cantonments at Candahar, Cabul, Quetta, and other minor places were completed.

An elaborate system of defence of the Cabul basin was carried out.

Lastly, but not least, the Commanding Royal Engineer naturally became the prominent man in the siege of Candahar.

From the above you will see that the greater portion of the work executed by the military engineer was "pioneer engineering" and the Royal Engineer Officers who excelled in this were those who in peace time had had opportunities of organizing labour and of exercising their own resources. At present, there is a tendency in India to fold all Royal Engineer Officers into the arms of the Military Works Department, where now that military accommodation is more or less com-

plete, routine work will be, generally speaking, the order of the day. This policy is, I think, to be deplored, and if in a future war our Royal Engineer Officers have not had the varied experiences they gain now, the Indian Government may learn to regret the change they are inaugurating.

### III. *Survey and Reconnaissance.*

This campaign was remarkable for the amount of new country surveyed by the Officers of Survey Department in India. The total areas surveyed and reconnoitred during the whole campaign were, roughly, 23,000 square miles in South Afghanistan, and 17,000 square miles in North Afghanistan, in all 40,000 square miles, or about the area of England without Wales.

### IV. *Native Army.*

Our Bengal Native Army, as a whole, proved itself of remarkable excellence. The men marched well, endured hardships patiently, had few wants, and fought well. The Punjaub Frontier Force carried away the palm of excellence. They are a body of practical soldiers. They have *good* native Officers, who, in the ordinary duties on the frontier, take independent commands of outposts, and consequently learn to trust themselves.

This want of good native Officers is the great blot in the organization of most native regiments. Attempts are being made to rectify it, and if this most important change can be effected, if young smart native gentlemen of rank and position can be induced to take commissions, the native regiment will prove itself second to none in efficiency and solidity, and no longer will a General issue an order that no party of sepoys are to proceed on detached duty without a British Officer.

### *Should Afghanistan be annexed?*

If one considers the enormous expenditure in material, transport, and men required to maintain the different lines of communication, is not one led to believe that the annexation of the whole of Afghanistan would strain the Indian resources to a hurtful degree? Let me for one moment refer to the Khyber-Cabul line. On this line, 200 miles in length, it was found necessary to maintain a force of 15,000 men. Some twenty posts and forts with their endless commissariat yards and transport yards had to be maintained. In addition to this, thousands of transport animals had to be fed and organized; and all this to keep the line of communication to Cabul intact!

These few words give very shortly an idea of the magnitude of the operation in maintaining the Khyber line of communication alone; but it remains to me to tell you how detestable the country and climate was; how the men died from cholera, fever, and intense heat; how life was unbearable during the hot weather from an "infinite torment of flies," and how the British and native soldier hated the life on that Khyber line with a bitter hatred. Service in Afghanistan had grown so unpopular in the Native Army that recruits came forward in but

scant numbers; and this growing unpopularity, together with the enormous cost in material, transport, and men, appears a sound and valid reason for abandoning Cabul.

These remarks do not refer to Candahar, which is differently situated in all respects.

The line of communications to Candahar is easy to maintain. It is not liable to attack by turbulent Ghilzais and Afreedees. As far as the Kojack Range from Dadur it passes through friendly tribes. From the Kojack onwards the road lies through an open plain, and could be easily guarded by some six or eight posts. In a few years a railway would have run on to Candahar city, and this railway would in all probability have developed such a carrying trade from Central Asia that it would, in addition to the fact that it was a strategical railway of the first importance, have returned a fair percentage on the outlay.

Candahar is, as General Hamley has already stated, the key of the position. He has proved that in a most masterly paper,<sup>1</sup> and since he wrote that paper, it has been practically proved that the line of communication to Sukkur is an easy one to hold, and that, with the exception of the Bolan and Kojack Ranges of Mountains, the railway engineer has no difficulties to overcome.

With these deductions the question one feels inclined to ask is—Having gone to Candahar, should we have ever left it?

The CHAIRMAN: Captain Hoskyns has given us an admirable lecture, and one of great interest. He has not only given us an account of the engineering work, but also a most interesting narrative of the campaign in a very short, succinct, and exceedingly clear form. I believe he will be ready to answer any question which may be put to him as to any of the points of interest that he has brought to our notice, and we shall be glad to hear any observations that any gentleman may like to make with reference to them.

Major-General Sir JAMES HILLS, V.C., K.C.B.: Ladies and gentlemen: this lecture is particularly interesting, and I consider that in most of the details there is no exception to be taken to it; but there are one or two places in which it is misleading, and I should like to take notice of one in particular, as the public generally has misconceived ideas about it, and that is the paragraph in which Captain Hoskyns says, "The British force had been within an ace of a great disaster, and by good luck had escaped a beating in detail." That was with reference to the fighting about Sherpur. "The prospect of loot in Cabul turned the Afghan's attention from Sherpur, which he might have assaulted with every chance of success." Now, I would wish to state that the cantonment of Sherpur was never at all in any danger. General Roberts had a very difficult task to get through, but had no thought of his cantonment being in any danger, as will be seen by his leaving me with 100 sepoy throughout that eventful day in the city of Cabul. General Macpherson's brigade had felt the touch of the enemy that had driven back our cavalry and taken our guns, and was driving them away, when the advance of their troops was checked from getting into the city by the 72nd Highlanders. They never intended, and never dreamed of attacking Sherpur that day; in fact, they had not enough men to do so. The great mass of men that eventually forced back General Roberts into the Sherpur cantonments came up the next two or three days. General Macpherson had beaten the force which came from Kohistan the day before, and it was his next duty to attack those men

<sup>1</sup> See Journal, vol. xxii, No. XCVIII.

who drove back General Massey. They had moved forward during the night, and coming first upon General Massey, an action took place, but the moment that this was heard, General Macpherson moved up, and would have been ready to drive them away had they proceeded to Sherpur; and there were enough men in Sherpur to withstand the attack till General Macpherson came up. Therefore I would wish you to know that Sherpur was never in any danger. Had they not been checked, they would have looted the city that day, because it was full of blackguards who would have aided them, but still General Roberts was so little exercised about this possibility, that he left me inside the city to look after it till half-past ten o'clock at night. Then again, with reference to the danger of General Gough's advance, I would wish to say that General Roberts showed his foresight and knowledge of his enemy in feeling really no great anxiety about General Gough's advance, for he felt assured that the whole of the tribal contingents would hold on to the city of Cabul itself. Had they, however, gone down to attack General Gough in his advance, General Roberts would have been prepared to send out a division to assist him, but in keeping the mass of the enemy there, he felt quite convinced that General Gough was really in no danger, and that whatever troops went against him he was able to contend against them, and would force his way through without any great fighting or any great danger. He was in anxiety about the regiment at Luttahund. There was one regiment there, and without doubt he was a little anxious about it, although knowing that General Gough was within two marches of it; when General Gough came up there, his mind was at ease, and he was then quite satisfied about General Gough's advance. The observation made about the march of General Roberts and General Stewart is quite a correct one. I quite agree that the public took perhaps an excessive idea of General Roberts's march in comparison with General Stewart's. He was most splendidly equipped, and thus enabled to make his celebrated rapid march. The public at home considered it was a most dangerous movement to come away and leave his base, but both General Stewart and General Roberts were quite satisfied that there was never any danger whatsoever in that movement, and that it was quite a proper one to make, for when you have got troops sufficiently strong to be able to hold your own, and drive the enemy away, transferring your base from one side to another is quite an authorized movement. The observations of Captain Hoskyns about the principles of attack are quite correct, but he ought to allow it to be left to General Officers commanding to make up their minds whether the new system of attack is the one to use when you are fighting troops armed as the Afghans—an undisciplined horde—or the system of the old line formation. In fact, the country itself directs the General what he should do, and the lines which are laid down about the new system of attack are not so strict that the General Officer who knows what he is doing should not be able to alter them. With reference to his notice about the points of interest and the lessons learnt, I consider that he has most forcibly brought them to the notice of this meeting; and I agree with him in most other points except, perhaps, his hope about the native Army and native Officers. That is too large a question to go into. One hopes that the native Officers will improve, but there is a long time before us before they can get to that state of efficiency that they will be able to lead companies without a European Officer supporting them. He states, "Service in Afghanistan had grown so unpopular in the native Army, that recruits came forward in but scant numbers." The fact is, that there was a tremendous drain made for recruits, a much larger one than had ever been made before; and therefore there was naturally a difficulty in getting a sufficient number, but I believe myself that the service was fairly popular, and I am quite positive that those men who served at Candahar liked the cantonment service there almost as well as any place in India. They were particularly fortunate with reference to vegetables and fruit, which they obtained there in any quantity, and for almost nothing, and if after a year or two they were relieved, I am certain that the service at Candahar would be popular, instead of unpopular. With reference to the retention of Candahar, that is a question which is obsolete, and we need not go into it.

Lt.-Col. ST. JOHN, C.S.I.; There are one or two points of fact which I should like to mention, and which I am sure Captain Hoskyns will not be sorry to have corrected. With reference to the Maiwand affair he says, "Between the 18th and 26th Burrows

remained at Khusk-i-Nakud, his cavalry daily patrolling the country, but in such a perfunctory manner that no information was brought in; and on the 26th Burrows heard for the first time that the enemy's cavalry had entered Maiwand." Well, this last sentence conveys an entirely incorrect impression; the enemy's cavalry only entered Maiwand on the afternoon of the 26th, and General Burrows heard of their having done so in a couple of hours afterwards. As regards patrolling the country and doing it in a perfunctory manner, I would remark that before the 26th, with the exception of a single cavalry reconnaissance, there never was an enemy in force within thirty miles of General Burrows. Ayub remained on the Helmund, and his and our cavalry patrolled daily as far as a place called Sangbur—midway between us—this being about the furthest point they could reach in that waterless country. A great deal has been said against the troops in the Maiwand affair, but as far as the patrolling goes certainly without reason. They saw nothing, because there was nothing to see before the 26th. All they could do was to go fifteen miles into the desert and return. Maiwand, instead of being neglected as Captain Hoskyns has said, was visited every day. Colonel Leach was there several times, as late, I believe, as the morning of the 26th or the day before. Further on, again, Captain Hoskyns says, "The twentieth day of the siege the enemy had invested the town and held a strong position in the village of Deh Khoja." This conveys an erroneous impression: the siege did not last twenty days. Ayub only arrived at a place ten miles from Candahar on the 9th. General Roberts's force was within signalling distance on the 27th, some days before which the siege had been raised. Actually at the date of the sortie the Afghan Army had been before Candahar eight or nine instead of twenty days. Further on Captain Hoskyns says, "The result of this sortie was still more to depress the garrison, but fortunately rumours of succour now spread." A wrong impression has got abroad about this sortie. Although it was no doubt an unlucky business, the troops were not repulsed but withdrawn; and instead of depressing the garrison, I venture to assert on my own authority that it had quite the contrary effect. Nothing could have been more gallant than the way in which the three regiments engaged behaved—the 7th Royal Fusiliers, the 19th and 28th Native Infantry. The retreat to the town was performed quite coolly; and afterwards, instead of being depressed, I am sure that the garrison would only have been too glad to go out and fight Ayub's army had they been ordered to do so. Having gone into Candahar with General Stewart—left it with General Hughes three years and three months afterwards—I am in a position to bear witness to the extreme value of the hard work done by the Engineers there. And Captain Hoskyns, I notice, mentions that it would be a pity if the Engineers to be employed in future in Government military service were drawn solely from the military works branch; I can testify from my own experience that the best men on service are those who were employed on the great railway and canal works of India. I would particularly mention, and I am sure Sir James Hills would agree with me, that the services of Captain Bisset and Captain Call, both railway men, were most invaluable at Candahar. I would also join General Hills in testifying to the *agrément* of the cantonment of Candahar. It was not half a bad place. The troops were from many points of view delighted with it. We had an unlucky turn of cholera, but there is plenty of that in India. The service on the line of communication was certainly unpopular; but in Candahar itself, in Quetta, and the whole of the Peshin Valley, where I spent the whole of last summer with the troops, the service was certainly not unpopular; and I think, although the troops were glad to get away, what they disliked was the uncertainty. They said, "We should not mind if we knew that we were to stay here, but what we do not like is this, not knowing anything about what is going to happen."

General MACLAGAN: Sir, there are two observations which I desire to make, and they are of a different kind from those we have just heard. We have had the advantage of hearing remarks on points of much interest relating to Cabul and to Candahar from two distinguished Officers who took part in the operations that have been described. General Sir James Hills, who himself was at one time the Governor of Cabul and holding an important position in General Roberts's force, is well acquainted with the details of the matters to which he has referred, and Colonel St. John, who occupied a political position of the highest importance at Candahar.

The observations I offer are those of one who was not engaged in any capacity in the campaign in Afghanistan, and they are of a more general character. First I would express my entire concurrence in the remark of the lecturer on the subject of the employment of our Engineer Officers in India in time of peace. There is the tendency he has referred to, to employ the Royal Engineers, being military Officers, as much as possible in the military works branch, and to dissociate them from works of other kinds. I consider this increasing limitation of the employment of Engineer Officers to military works likely to have the effect of detracting greatly from their efficiency in time of war. Not only in the campaign now under consideration has the varied professional experience of the Engineer Officers been, as Colonel St. John has observed, most valuable. On every occasion on which their military services have been required in India, their practical acquaintance with the organization of work and management of large bodies of men—what may be briefly called the application and economy of labour—as well as the variety of their professional experience, has been of the greatest service. And nowhere has this practical knowledge been better gained than on our great roads, railroads, irrigation works, and others entirely of a civil character. Our military works in India are for the most part those belonging to barrack buildings and cantonments, and it will not be for the advantage of the Government service, or of the Officers themselves, if their professional practice, in what has hitherto been so wide and varied a field, is to be thus restricted. The other point which has struck me in listening to Captain Hoskyns's lecture is the way in which he has turned to account the most ordinary opportunities of an Engineer Officer on active service, with no exceptional advantages, and holding no prominent position, but employed as one of a number of Engineers on one part of the operations he has described (and here I would observe in passing that in the whole course of his narrative we have seen nothing of Captain Hoskyns himself), he has gathered the materials for a very interesting account of the campaign and useful observations on the professional points which presented themselves to his notice. It has sometimes been said that a man who has something in him does not need to have opportunities afforded him, but can *make* his opportunities for himself. This is true only to a certain extent. Opportunities are needed; what is really useful is to be able to discern opportunities when they occur, and to be able to seize and use them. I speak of Captain Hoskyns with some knowledge of what he has done in other ways, as he was employed as an executive Officer under myself in the Punjab on the ordinary engineering works of peace times to which he rightly attaches so much importance. And I would remind any young Officers of Engineers whose lot it may be to be employed in that large and most interesting field of labour, the East Indies, and indeed in any other, that they can make the same use of their opportunities, if to the professional knowledge and skill they add the vigour and the energy of Captain Hoskyns.

Sir JAMES HILLS: As Colonel St. John has appealed to me to support him in his views about engineering, I would just wish to say that I most thoroughly do so, and I agree with him in what he says.

The CHAIRMAN: As Colonel St. John has had such large experience in the part of Afghanistan which has been referred to, I should much like to ask him whether the views he has expressed with regard to Candahar being a good station at which troops can live with comfort would be applicable to the Peshin Valley and Quetta, and the districts in that part of Afghanistan.

Colonel St. JOHN: Quetta and Peshin are higher than Candahar, and therefore cooler; but Candahar is a town of 30,000 inhabitants, in the middle of a highly cultivated country abounding in provisions. I suppose a thing hardly ever came from India except luxuries. Everything that was wanted by General Stewart's army, and by the successive armies that were there the next year, was found in the country. It has large bazaars, which troops like, and, therefore, I think it would be always more popular among the troops than Peshin or Quetta. As regards health I am inclined to give the palm to Candahar. I think it is decidedly more healthy than Quetta. Peshin is a place in which you cannot keep any very large number of troops. It is a comparatively small valley with scattered villages here and there, mostly with bad water, and the few sites that are found are tactically very bad. Every year that we have been in Quetta, it has been found necessary to

more a portion of the British troops to the very summit of the Kojack, where, with infinite ingenuity, a camping ground for 700 or 800 men has been made. Therefore I think that Quetta and Peshin are not so good stations for troops as Candahar. They must necessarily be scattered; provisions are less plentiful; luxuries, such as fruit and vegetables, are far more difficult to obtain, and the only advantage which they have is in being cooler.

SIR JAMES HILLS: I would like to ask Colonel St. John whether, if a railway went up to Peshin, the place could not be made more habitable for a large number of troops, and also whether there is not a plateau on the Kojack range itself which could be very well utilized for troops when the heat in the plains of Peshin is excessive; in fact, whether or not Peshin would be fairly useful as a cantonment for the troops, supposing we held it?

Colonel St. JOHN: It seems to me that the holding of Peshin is not a very material point as long as we hold Quetta. The great thing is to have a position above the passes. It matters very little whether it is at Quetta or at Khelat, or further east or further north; the advantages at Peshin are more political than strategical I think. It keeps the Afghan Government with its various inconveniences at a distance from Quetta. There is a well marked frontier between Peshin and the rest of the Candahar province. There is none at all between Quetta and Peshin. It is impossible to see when you pass from Quetta into Peshin, which comes inconveniently close to Quetta. It is not a rich place, and it is not a particular healthy place. If the railway goes on to Harnai I should myself rather advocate the transferring the main body of the troops to some convenient station about there, and keeping Quetta as a civil station for the Resident. But, without a map, it is very difficult to make that clear. As regards the plateau on the north, I suppose Sir James Hills alludes to the plateaux of Tabin and Tobah. They have really never been explored since the first year we were there. There is a certain amount of water, I know. In most years the climate is very cool indeed. I think the cold would be too intense for a permanent military station. They would make, perhaps, good summer stations—perhaps better than the Kojack Pass, but they would not do for a permanent cantonment.

THE CHAIRMAN: As I see no one rising to continue the discussion, I will make a few short observations. I quite agree in all that General Maclagan has said as to the excellence of the lecture that has been given by Captain Hoskyns, and the example he has set to young Officers to make use of the opportunities afforded them to improve themselves in their profession, and to bring themselves to notice. It is also worthy of note, as General Maclagan has observed, how very modest the lecturer has been. In all that he has said he has not alluded to himself in any way whatever. I am very glad to have heard the observations that were made by Sir James Hills on the subject of the holding of Cabul during that critical period in December. It is very satisfactory to hear from an Officer who had such opportunities of judging, and who held such an important command in Cabul on that occasion, that the cantonment was not in danger, contrary to what I believe to have been the general impression in England. As regards what is called "the siege of Candahar," I think it is very desirable in all military questions of this sort that we should be very careful in using accurate terms. Now, so far as I understand, there was no siege of Candahar at all. We heard a great deal during the Russian War of the siege of Kars. There was no siege of Kars. The Russian troops surrounded it. They never raised a battery against it. They blockaded it and starved the garrison out. Well, so far as I have heard, the siege of Candahar was no siege at all. There were no works thrown up, I believe, to attack it. It was invested, the enemy occupying the surrounding villages—one in particular, against which there was a sortie—the village of Deh Khoja. It was very close to the walls of the town, but such an occupation does not constitute a siege. There was none of that constant work and labour which is thrown upon a besieged garrison, in consequence of being exposed to perpetual fire from batteries erected with a view to doing the greatest possible amount of injury to the besieged. The investment of Candahar went on for some time, and no doubt with regard to that sortie, whether the troops were withdrawn or not, the practical result of it was the same. If the troops were not driven back they had to withdraw within the town, so that the practical result is much the same.

It is satisfactory to hear that the garrison were not disheartened. But there is one very unfortunate feature in that campaign, which one has never heard explained. That is what has been alluded to by the lecturer—that the troops retired into the town of Candahar after the battle of Maiwand, having abandoned their military stores, tools, and other things, which would be of most essential importance in the town they were going to defend. I was not aware until it was stated by the lecturer just now that that was the case. I knew that some of the impedimenta were left behind, and naturally concluded that the heavy baggage and luxuries had been abandoned, including, I believe, an immense quantity of wine and beer; but I never imagined that the troops had retired into Candahar, leaving behind them such important things as tools, when not compelled by pressure from the enemy. It struck me as so very remarkable that I could not fail to observe it. A point has been raised, and a few words spoken on it by General Maclagan, as to the employment of Engineers during peace. I quite agree with General Maclagan in all that he has said; and I go a long way farther. I think it is a great misfortune to our Indian Empire that every single man in the country employed in any way by the Government is not a trained soldier. We hold India by the skin of our teeth, to use a common expression. The number of Europeans in India is exceedingly small, and it would be an immense advantage to us if every man had studied and been trained and had some experience as a soldier. I not only wish that Engineers were employed in civil works, especially large works like railways, as they are now, which afford a very good training for the military duties which may devolve upon them afterwards; but I should be glad to see the whole body of civil engineers who now pass through a training college in England converted into military engineers, and thoroughly well trained as such, that they might take charge of the railways and put them in a state of defence if there should arise another mutiny or a critical time like the mutiny. I should be glad to know that their military knowledge was such that they could organize a system for their protection, when their military rank would be found of the greatest benefit in communicating with the troops, in carrying them on the railways, and taking measures for the security of the various lines; it may, I think, be some day of the greatest consequence to England that such should be the case. I have no further observations to make, but would ask you to allow me to convey your thanks to Captain Hoskyns for the excellent lecture he has given us, and for the admirable manner in which he has brought the subject before the meeting. One word more. I should like to call attention to the beautiful drawings with which the lecture is illustrated. Not only those in front of you, but those around you, are well worthy of your attention. Some of them have been drawn by my friend Captain Bartram. The views show great artistic taste, the plans are exceedingly well done, and, I think, all deserve your high approbation.

Friday, May 12, 1882.

COLONEL LORD ELCHO, A.D.C., M.P., &c., in the Chair.

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### MAGAZINE RIFLES.

By Lieutenant-Colonel G. V. FOSBERY, R.C.

THOSE who are familiar with the records of this Institution, and at the same time acquainted with the contemporary progress in the arts of war, cannot fail to have observed how often problems mooted for the first time in this theatre have later on been found to demand universal attention, have forced themselves to the front both at home and abroad; and, finally, whether by the means here suggested or otherwise, have been solved to the great advantage of the public and the increased efficiency of the Services. To contribute to such results must be always an object of ambition, and the hope of doing so in however small a degree makes me attempt to-day the treatment of a subject which, unlike so many which we have heard here discussed, can from its nature contain neither brilliant description nor attractive novelty, and which is, perhaps, too purely technical and mechanical to excite any very general interest. Moreover, others have spoken on this question before me, though perhaps its full importance is not even yet recognized. All that I can expect to do will then be to contribute something to your information on the subject, emphasize the importance of a careful study of the several questions involved, and after considering the various types into which Magazine or Repeating Rifles are divided, describe the advantages and disadvantages which seem to belong to each system. Before doing so I will, however, lay before you a few of the reasons which, as it seems to me, press on us their general adoption into the Service. To do this will involve a short sketch of the general situation as regards the soldier and his present armament in face of the new set of conditions under which all fighting will be conducted in the near future.

Those who were interested in the old controversy on breech-loaders will remember how often it was asked by our opponents what good purpose could possibly be attained by giving the men a gun capable of being fired at more than a very limited speed, for, said they, the soldiers will inevitably misuse it, in so many minutes (carefully calculated) the pouches will be empty, in so many more, the reserves will be exhausted, and then the enemy will fall on your defenceless fighting line and make mince-meat of it in a moment.

We, however, who took a different view, would point out that the less time it takes to load a gun, the more time may be safely devoted to aiming it, and that thus a weapon capable of developing the highest

rate of fire, on an emergency, will also be far more effective when fired slowly and deliberately than one where time is wasted in needless manipulation.

Furthermore, we held that economy of cartridges should be effected not by the inefficiency of the weapon, but by the improved fire-discipline of the soldier. And, finally, should the worst occur and the fighting line exhaust the ammunition both in pouch and reserve, we did not believe that the process would, under ordinary circumstances, leave any enemy in that degree of fitness for an instant and vigorous offensive which for the sake of this argument our opponents maintained would be probable.

In short, we upheld the principle that, as the fighting machine, which it was desirable to bring to the highest perfection, consisted of two parts, a man and a rifle, the mechanical part, *i.e.*, the rifle, should be the quickest and best attainable; and that the other part, *i.e.*, the man, should then be levelled up to it by careful instruction. We all know that these views at last prevailed, so far as the rifle was concerned, and the result is that our men, for the moment, carry the most formidable and far-reaching weapon in Europe, not that we have by any means even yet taken full advantage of its enormous range (over 4,000 yards) by general arrangements for enabling us to use it at anything approaching its full distance.

If we turn for a moment from the rifle to the man, such of us as were trained under Colonel Wilford will remember his constant insistence that the end and aim of all tactics and of every manœuvre being but to place the man in the most favourable position for using his weapons with effect, he should before all things possess that familiarity with the construction and powers of the rifle which begets confidence in the weapon, and that skill in its use which goes far to make a self-reliant and fearless soldier.

Since that time, the lessons taught in the Hythe lecture room have borne their fruit in the high degree of perfection in target shooting which is now attained by the Army in general, though the practice at fixed objects and on measured ranges, together with the limited allowance of ammunition, still, I fear, keep a large number of our men from ever gaining that quick instinctive judgment, that *ensemble* of hand and eye, which is possessed by nine-tenths of the sportsmen, gamekeepers, and poachers in the kingdom. For we must not lose sight of the fact that our present system, which up till now has done us admirable service, was initiated at a time when tactics were in a state of transition, when close formations were still considered practicable under fire, and when neither that of infantry nor of artillery had attained its present development.

Shrapnel, except in our own Service, was scarcely used in Europe; machine-guns were still locked up in the brains of unbreeched inventors. The Gras, the Mauser, and the Martini-Henry were, so to speak, unknown quantities, and we had still amongst us men who believed firmly in the fire tactics of the Peninsular War. Among other things we must recollect that the changes which have been forced on us by the accuracy and range of the new weapons have completely altered the class of object

at which the soldier will have to shoot on service. It is most important, therefore, that his training in time of peace should, to a certain extent, undergo a like modification. For as he will never again stand shoulder to shoulder with his comrades and fire volleys at similar lines at 400 paces, so he will seldom find a skirmisher waiting to receive his fire at 300, but he will continually be called on to take snap shots at running, bounding, dodging men at every conceivable distance within the range of his rifle, to hit heads half shown above shelter-trenches, bushes, or tufts of grass, or pay in his proper person the penalty of his bad shooting; and he will have, moreover, while lying under cover himself, to learn to judge the distance of his enemy, which is a far more difficult thing to do than is generally supposed, and one too seldom practised.

We have lately heard a good deal of the difficulties encountered by our men when pitted against an enemy whose sharpshooters got their subsistence by their rifles in a game country, and necessarily shot magnificently, and who, thoroughly understanding the deerstalker's craft of approach and concealment, used them with deadly effect in war. But it is evident that such incidents will henceforth be of constant occurrence in European warfare, and that we shall need to practise them for use against civilized as well as semi-barbarous foes.

Our man is therefore surrounded by new difficulties on all hands, while the looseness of our modern formations requires in him a higher degree of reliance on his own skill and judgment than was the case when one or two crack shots would find the range for a whole company, and all were inspired by the high looks and bold bearing of a favourite Officer or a trusted comrade. Is it to be wondered at that a more elaborate and more thorough training is required to bring up the soldier to the level of these new demands on him; or that, looking to the man and gun as parts of the same machine, it should be strongly held by some of us that a still further improvement of the mechanical-half also is again required?

Again, while deprived of the support which close formations afforded, the soldier must become sensible of the diminished intensity of the fire under cover of which he advances—a fire feeble and irregular as compared with that delivered by close formations. The flattened trajectory of the modern rifle and the rapid action of the breech-loader have rendered the firing of lines so destructive that line-firing can be no longer executed, but inasmuch as line-firing is a thing much to be desired on occasion, what if we could cause the single man occupying the ground formerly filled by two, to regain his lost advantage by firing on suitable opportunities two shots where he now fires one, for his own protection as well as for that of others? Besides this, the tendency of all modern attack has gone further and further in the direction of “doubling on one's enemy,” as it used to be called in naval tactics, and whether by flank movements or otherwise bringing a large force to bear on a small one, and rolling it up before assistance can arrive. In very many cases these tactics must be successful, if only the blow has been properly prepared for and driven home in the time calculated.

But a great factor in this question must always be the relative fire-power of the two bodies engaged. To double the number of assailants only means to double the amount of fire on the point chosen for assault up till the moment of coming to close quarters. Could those thus attacked double the amount of their own fire at will, it is evident that the advantage expected would be in a great measure lost.

Again, it must be borne in mind that the time occupied in the final rush which forms the last stage of attack is exceedingly short, and that every additional round per man that can be poured into what now becomes for the first time the sort of target we have been used to, will prove of untold importance. These are the minutes and portions of minutes which govern the success or failure of movements which have been hours, perhaps days, in preparing; and could we give our men for such occasions weapons which, like a machine-gun, would pour forth a continuous stream of projectiles, it is not too much to say that we should be wise to do so, for they would become invincible.

Failing this, no conceivable increase in the rate of fire of the infantry arm would be too great if unaccompanied by mechanical complications and involving the use of a weapon neither too cumbersome nor too heavy; not that it would probably be ever necessary to deliver more than eight or ten rounds at such extreme speed; the thing is to be able to get off those eight or ten rounds in the right direction, in the minimum of time, and at the proper moment. For this reason I consider that the numerous tables which have been compiled regarding magazine-guns only tend to lead us away from a right consideration of their uses.

In every case you will find the rate of fire of the magazine-gun compared to that of the single-loader for a minute or two minutes' consecutive firing, including the time taken to empty the magazine, the time to re-charge it, empty it again, and so on, as compared with the continuous but slower fire obtained from the single-loader. In my opinion the comparison should be made between the ten shots fired, aim being taken, with the magazine arm as against ten shots fired under like conditions with the single-loader; and again a like speed trial firing from the hip, as is often done at close quarters. Then a comparison should be made between different forms of magazine-gun as to the time in which each system of weapon can be re-charged; and finally, other things being equal, the preference should be given to that system which, within limits, contains the largest number of full-powered cartridges and the simplest mechanism. The magazine, if forming part of the gun, should be shut off and thrown out of work till the men get the word of command. If attachable, it should be kept in pouch and fixed at the proper moment, as we should fix bayonets. And as I have said before, if used under such control as this and at the right moment, there would probably be very little necessity indeed for re-charging and repeating the operation; the affair would practically be over. Had the gallant 24th possessed weapons of this class and used them at the moment the horde of savages came to close quarters, when every shot must have told, it is questionable if they could have been overborne even by the vast masses opposed to

them; and the same may be said in other cases with which the history of recent wars has supplied us.

Consider, too, the effect which the possession of such weapons must have on the *morale* of those who carry them.

Some of you, gentlemen, must have probably once or twice in your lives stood up before an infuriated beast, or a human enemy no less formidable, having fired your single barrel at one or the other without effect. If so, you will I daresay remember the sensation which accompanied the act of feeling for the next cartridge, and can understand what a relief it would have been had you only carried a weapon which, like this, would have re-armed you in an instant. So powerful is the effect of this feeling of helplessness, when the enemy is close upon us, that many men, sooner than run the risk of meeting him with an empty rifle, have been known to retire for the purpose of reloading, and their motives being misunderstood, the movement has been imitated and a general stampede has followed; indeed, there can be no doubt that many a charge which has been pressed home could never have succeeded but for the panic which has seized on the unloaded ranks.

In short, it is becoming daily more necessary to endow the soldier, for special occasions and for brief intervals, with a far higher power of attack and defence by means of fire than he now possesses in any system of single-loader whatever; and under the new perils in which the changing art of war involves him, to afford him the moral support and physical aid which the possession of these powers and the skill to use them cannot fail to give; his weapons, too, being not only calculated to give the best combined effects, but such as will enable the isolated skirmisher to give a good account of two or three of his enemies. This, notably, several times happened during Sherman's march on Atlanta, where some of his flanking regiments carried magazine arms.

It has been in accordance with some such views as these that the magazine-gun has been devised and brought to its present state of efficiency, and arguments, much of the nature of those which I lay before you now, press its general adoption on the Powers of Europe.

Captain James, in an occasional paper on this subject, has enumerated some of the systems which have already been adopted or brought prominently forward, and from it we learn how far the movement in this direction has already gone.<sup>1</sup> Nor can there be much doubt of the correctness of his general conclusion that the magazine or repeating rifle is the weapon of the future.

No doubt, for the reasons which he sets down, some compromise with the present systems will, if possible, be used during the interval which must elapse before re-armament will be possible.

By this we understand that one or other of the systems of quick loaders or attachable magazines, of which there are several, will be fitted to the weapons now in use, where the construction of the weapons themselves will allow it, and this can be done in the case of the Martini-Henry, the Gras, the Mauser, the Berdan, and Comblain rifles,

<sup>1</sup> See Journal, vol. xxi, No. XCVIII.

in fact, to all the weapons now in use in Europe, with the exception of the Remington and the Austrian rifles, which from their construction would render such an addition extremely difficult; both also being far behind the other systems named, must sooner or later be replaced by newer types, and will probably be changed for magazine-guns direct, so soon as the Powers employing them are in a position to do so.

The Austrians, however, have already, by an ingenious arrangement of the cartridges in pouch, done all that is possible to increase the rapidity of their slow-firing weapon.

But if the vast armies of the Continent, notwithstanding the perfection of the arms which they carry, are now seriously meditating this change, how much more necessary will it be for us, outnumbered as we must always find ourselves in any European war, and outnumbered as we always are, even in our engagements with savages? Can we, under these circumstances, afford any longer to refuse to our soldiers that assistance which our skill in mechanics and our unrivalled machinery gives to every other class in the State?

A most ably conducted and exhaustive set of trials has already determined that we have a system of machine-guns, by which one or two men can do as much destruction as say 40 ordinary soldiers, and *that* without the chance of deranged mechanism or the complications which formerly militated against their use; and yet, though it is certain that an enemy will always do the unexpected thing, and if an European one, use machine-guns against us, we neglect to acquire them for the Army because the exact tactical place for the weapon is as yet undiscovered. Shall we in like manner investigate the merits of repeating rifles, seal the pattern of the selected type, and pigeon-hole the reports until some new and signal instance of the insufficiency of our present arms for every contingency of war unlocks the public chest, and, all too late, sets Enfield at work for its production?

I say all too late, because, though many things necessary for war may be provided at the last moment—stores of all kinds manufactured and despatched, men in certain numbers raised, horses bought, and ammunition prepared faster than it can be expended, the same is not the case with arms. Were it decided to-morrow to re-arm the whole of our forces with a rifle of a new pattern, nine months would at least elapse before a single weapon could be made, two years more before the arms could be supplied, and probably another two years before the reserve arms necessary could be put into store. Nor could we now, as formerly, count upon *the trade*, as it is called, to assist us, for the military arms trade is in a dying condition; the great Birmingham factories are making bicycles for their support—their staff dispersed, their beautiful machinery idle and rusty, and the skilled hands, obtainable at one time in any numbers, dispersed to the four winds, sunk into drudges of the African gun-traders, or unwilling accomplices of those little shopmasters who vie with one another in the arts of making saleable gun-barrels from gas-pipes, and gun-locks and furniture entirely out of cast-iron. I do not say that Birmingham has not been to blame, both masters and men,

for this catastrophe, and those will agree with me who know best the history of their conduct when orders still came to them of late years, how some masters reduced the men's wages to starvation point to make the larger profit, and the men retaliated, when the masters were once committed to a contract, by prolonged and vexatious strikes for higher wages and shorter time, how so many also combined during the Franco-Prussian war to sell worthless arms and unsuitable ammunition to both sides, until, in self-defence, America was called in to compete, and foreign Governments established factories of their own with English assistance. All this is true, and more, yet the results are not the less a national misfortune, and in case of war, might become a source of national danger; and it would be to follow a kind as well as a wise policy could the great establishments and splendid plant, of which I have spoken, be saved from being finally broken up and dispersed, by such a subsidy or such occasional orders as would cost the State but little, and would preserve them for use in the time of emergency or re-armament, when the productive power of the country could be more than doubled by their assistance.

For even should we consider our splendid factory at Enfield, organized and equipped as it is, sufficient for all our requirements, we must remember that it is no more exempt from accidental or wilful damage than any other aggregation of bricks, mortar, and machinery, and that were we to depend upon it alone in time of war, a fire, an explosion, or a breakdown, might work us untold mischief.

I say of war, for do we not, at this moment even, find ourselves surrounded by enormous armaments, and in a position of unstable equilibrium; where a false movement on our own part, or the neglect to interpose and resist encroachment on the part of others, may at any time precipitate a conflict of which no one can calculate the results?

This, moreover, is certain, that of all the causes which have determined the issues of later wars two stand pre-eminently forward, and rivet our attention, viz., the organization and instruction of the infantry soldier and the weapons he has carried.

Passing over the earlier triumphs of the needle-gun, who can fail to have observed how notably the superiority of the weapon carried by the Turks prolonged their defence, and at one time all but ensured their success?

Has it not also been asserted, that one of the causes which made the Germans precipitate their struggle with France was the report of the contemplated re-armament of the French line with a superior weapon, which would shortly have placed themselves at a disadvantage in the matter of arms? The adoption of the Vetterli repeater by Switzerland, though this is a magazine-gun of inferior mechanism and comparatively low power, has caused that nation to be regarded more than ever as a nest of hornets on whom it would be unsafe to lay a hand. It is certain that a most emphatic "*Noli me tangere*" will be pronounced by the nation that shall first arm itself with a repeater of full power and of modern type, and will be religiously respected until others stand in a like position. Why should that nation not be our own? and why

should we not in this way relieve ourselves, for a long time to come, from the disquieting rumours of trouble that now and again disturb our peace and alarm our commerce?

It may be urged that I am advocating the use of untried arms, a use not justified by any sufficient experience on actual service; but this is not the case; as you will remember, both the Spencer and Winchester repeaters were employed in large numbers in the American war,—which is not a thing of yesterday,—while the Winchester was made use of with deadly effect by the Turkish troops.

I remember hearing a Confederate Officer relate his first experience of the Spencer rifle, and though the name of the place has, I am sorry to say, escaped my memory, the other details have not.

He stated that the Federals had occupied and stockaded a strong position on the top of a hill, commanding, if I recollect right, the passage of one of their great rivers, a position from which it was necessary they should be expelled if possible at once.

A strong storming party was accordingly formed, and assembled at nightfall in a woody bottom at the foot of the hill. When the moon rose, they commenced silently to ascend, until at last they saw just above them the long black parapet against the sky-line apparently without a defender.

On some sound being made, however, the alarm was given, and in an instant the parapet was lined with heads, and a volley poured into the assailants at close quarters, which was almost instantly followed by a second. This was a war of surprises, and coming to the conclusion that their enemies had double barrels and must now reload, the stormers cheered and rushed at the work; but they had reckoned without the Spencer. Five more volleys followed the first two without a second's intermission, and the broken remains of the party took refuge in the bottom to attempt that post no more.

On another occasion a Federal brigade, which had already suffered severely in action and was reduced to a fraction of its original numbers, came in sight of a vastly superior body of the enemy, which instantly made preparations to attack, and moved down on them full of confidence, as my informant said, drums beating and colours flying.

For a moment everyone thought that all was lost. The Officer in command, however, understood his business and knew his weapons. He ordered the magazines to be filled, the men to take such cover as they could find and wait for the word of command. Nearer and nearer came the enemy, and still the thin line waited in dead silence. When, however, they got within a hundred paces, the order came out sharp and clear, and volley after volley from the repeaters mowed them down in an instant. The ranks fell one over the other in heaps, and the survivors, panic-struck at this sudden and unexampled slaughter, turned and fled, leaving the spoils of war to the enemy they had too soon despised.

Captain Sleeman, who had great opportunities of observing the Turkish fire at Plevna and elsewhere, has given me many interesting details of the way in which the Turkish fire was used against the enemy, and the immense expenditure of ammunition provided for.

If we want an instance of the use of a repeater in the hands of a single man we need go back no further than to the *Standard* newspaper of the 5th of this month, where we are told how an Irish landlord driving on his outside car into the neighbouring town on business likely to be displeasing to his tenants, and therefore not improbably fatal to himself, carries a repeater, and as he goes along sees a man get over the fence and take post on the road in front of him. As he passes, the man points a revolver at his heart and pulls trigger; the revolver snaps, and the landlord fires from the car and misses; he then jumps down, takes a steady aim, and shoots the man dead as he runs, and so closes the incident.

Do you think for a moment that had he had a single-loader *he* would have dared to stop, or the assassin would have turned to run? The chances are 50 to 1 the Land Lord would have retired to reload, and the Land Leaguer would have used his revolver again and killed him.

At this point I shall be met, I feel sure, by objections, even if you concede that for special purposes the magazine arms will offer us overwhelming advantages. The difficulties of ammunition supply, and training of the soldier to their use, will be two of these.

I have before implied that I do not believe the tendency of the magazine-gun need be to increase in any way the total expenditure of ammunition for an army, and I might add for a brigade, as compared with the present breech-loaders, though of course there will be always occasions in which with either one or the other that expenditure will reach, for fractional bodies of men, a very large figure.

Even now the question of supply is acknowledged to be one of our great difficulties, and will need to be met by an organization which will stand the strain of a state of war, and the rough methods of campaigning. But where the Turks succeeded, it is certain we need not fear failure, and even should our arrangements break down, there is always a way to perform the impossible, as was found in the case of that Commissary-General whom Picton threatened to hang unless the division got breakfast.

Besides all this, the difficulty disappears in exact proportion as you train your men. As a distinguished Officer said to me last week, a well-trained soldier will fire 20 rounds and kill his fair proportion; an ill-trained one will fire 50, and do nothing at the same time. The two questions thus go hand in hand, and if we are to perfect our man-killing machine, and increase to the utmost its destructive powers, a course to which we are driven by the smallness of our numbers, we must do for it all that it is in the power of mechanism and science to do in the first place, and we must bestow on it in the second, a degree of training which will prevent the machinery from running away with the man: such training as we have not even yet attempted, a course to which we are forced by the shortness of our service.

Colonel Sir Lumley Graham's account of the training of infantry for battle as practised in the German Army,<sup>1</sup> gives us a view of what is considered absolutely necessary in this respect by some of the best judges in Europe. And we must remember that *their* material to

<sup>1</sup> See Journal, vol. xxv, Nos. CIX and CXI.

begin with is of a higher class as regards education than our own, and therefore more easily reached by instruction,  $3\frac{1}{2}$  per cent. only being illiterate when first joining the colours.

How far we shall be able to proceed in our endeavours to make an ideally perfect soldier out of our own raw material in three years remains to be seen. But whatever parts of his education may be neglected or omitted, it is evident that habits of prompt obedience and skill in the use of his weapons must more than ever be insisted on. With his drill and other exercises my subject has of course less to do. The question is, how can he be so trained to shoot under the changed conditions of war, as to qualify him for a higher class of weapon, or to enable him to use the one he now carries, to the best effect.

There can be no doubt, I think, that in the first place his allowance of practice ammunition must be considerably increased.

For I do not believe that we could with safety omit any of the practices which he at present goes through, and it is evident that others will have to be added, for which ammunition will be necessary, and if he is to be made, as he ought to be, a quick shot, a great deal more ammunition ought to be given him than the country will consent to pay for.

That even our best men are but slow shots at moving objects was proved the other day when a picked team was sent out to fire at moving targets, and only fired at the rate of five shots per minute with the Martini-Henry.

Now we have heard, most of us, statements made as to the extreme rapidity of Martini-Henry fire, from 15 to 18 rounds a minute being often spoken of by good authorities as what may be expected of it. Indeed I have seen an expert whom they keep at Enfield who will fire 30 shots in a minute from ammunition placed on a table before him. What then can have been the meaning of these 10 shots in two minutes?

I fear it means that practice invariably made at stationary targets has a fatal tendency to produce what a sportsman would call *poking shots*, i.e., men who dwell too long on their aim, and that we are contenting ourselves with such a great deal too easily, both for the line and the volunteers; and we should find, were either called upon to meet a rush by an exceptionally rapid fire, that the fire was either infinitely slower than we have any right to expect, or, as would most probably be the case, that it was unduly hurried and almost entirely thrown away.

In such cases, even with our present training, the magazine-gun would greatly assist us, 1st, because the muzzle would be always pointed to the enemy; 2nd, because there would be no fumbling in the pouch for the next cartridge; 3rd, because the gun being instantly reloaded, an aim longer than ought to be necessary could be taken without decreasing the rate of fire.

But such shooting is always bad, and the hand and eye should be so trained as to do away with the necessity for it.

Prizes, as well as sweepstakes, should be given at Wimbledon for

firing at moving and disappearing targets, and our soldiers should be trained on similar objects as part of their annual practice. I do not mean with 10 or 20 rounds per man, but, if necessary, with 50 or 100, or even more, till the hand and eye work together, as do those of the average game shot.

This of course would be impossible on our present ranges and with any allowance of ammunition which the Government would consent to give them. But I have here two weapons, one English and the other American, which seem to me to provide the very thing needed in the shape in which we require it, and at a price which need not alarm the most rigid economist when the importance of the object we have in view is considered.

The Morris tube which you see here is to the infantry rifle much what the small barrel proposed to be used inside our ordnance for practice purposes is to the heavy gun, and is proportionately as cheap a method of attaining proficiency in shooting; it costs about a pound only. And I would undertake, with 10 of these tubes per company and 150 rounds of cartridge per man, to make fair snap shots out of 70 per cent. of the Army. Of course the practice could be carried on at spare moments or in wet weather in a barrack-room or a shed in the barrack-yard made for the purpose, and must be conducted as carefully and methodically as actual practice on the ranges. The tubes must be accurate and the ammunition scrupulously exact, or no good results could be hoped for, but given these conditions, a most valuable addition to our means of training is thus opened to us.

I should not attempt such practice until the men had become thoroughly accustomed to the recoil of the rifle, probably not until they had concluded the annual course, when I should train them at moving objects and disappearing targets with the tube, and afterwards take them out to fire whatever service ammunition may be allowed for the purpose, at running men, disappearing targets, or whatever objects or dummies may be selected at known and unknown distances. These practices should be conducted in all positions, and the judging of distance when on the knee or lying down also occasionally insisted on.

Since writing what I have just read to you I have learned that Major Brooke has lately spoken here on this very subject.<sup>1</sup> I have not been able to obtain a copy of his lecture, but I am very glad to learn that we agree as to the great practical use of this instrument for teaching our men more than can be taught with the practice ammunition alone, even though this has been lately increased to 150 rounds per man.

What the Morris tube effects in one way, this beautiful little weapon (the Ballard rifle, kindly lent me by Mr. John Rigby) does in another, and is to the match rifle much what the rifle and tube is to the Service arm.

You see here the targets which it is capable of making at from 25 to 100 yards. The ammunition, which is of American manufacture, is

<sup>1</sup> See Major Brooke's paper, since published in the *Journal*, vol. xxvi, No. CXV.

prepared with as much care as the weighed cartridges of a professional rifle shot, as these targets prove; and I cannot help thinking that these miniature arms and targets, especially when moving targets also have been devised and made for them, will prove, if properly and scientifically used, of immense advantage, both to our volunteers, who are just beginning to use them, and to the Army in general, who should do so.

I hear that both the Germans and French are already giving them their attention as a means of instruction for their troops.

So far for the possibility of improving the rapidity and accuracy of our fire, and of qualifying our men for the use of weapons of greater power than those we now possess.

The other point to which training should be directed is the subordination of the rate of fire to word of command, and this can only be effected by strict discipline, by practice with blank cartridges, and by a more extended use of volley firing by small bodies of men, such as sections or groups working under the eye and command of their Officers or instructors, who will watch and control all such excitement as leads to wild firing, point out from time to time the objects at which the fire should be directed, and maintain such a general supervision as will prevent the pouches being too soon emptied, the fire being thrown away from wrong sighting, or wasted, as I have myself seen more than once, on the ground or in the air.

With such teaching and discipline we might hope that no rifle, however good, would be too good for our men, should we take the great step in advance which all the Powers now look upon as inevitable. We need not fear, I think, that they could not be trained to make the best possible use of it: and the British soldier become what he ought to be, "*Celer et Audax*;" his courage, nature has given him, promptitude in war can only be gained by education and practice.

There is yet one other point which I think bears a most intimate relation to the training of the man, I mean the training of his Officer.

Now that the fire discipline of the soldier is acknowledged to be all-important, how comes it that at joining, the Officer should not be expected to know something about it?

He must pass a rigid examination in minor tactics, and know besides a host of things only useful to him in actual war, nay, only during the siege of a great fortress.

He must contain enough military law to try every criminal in the Army. But he may pick up when he can, and how he pleases, the elements of that science by which the good soldier must be trained up to play his part in the day of battle. Surely he should rather be expected to have *this* at his fingers' ends to begin with, though he should by no means neglect the rest.

I will now proceed to describe the class of weapons in the direction of which the approaching change will be made.

The idea of a magazine or repeating arm is a very old one indeed,

the first practical application of which was the revolver, if we except certain ancient and dangerous flint-lock weapons, which, containing power and ball in separate receptacles, brought them together in the chamber and pan of the gun by more or less complicated mechanism.

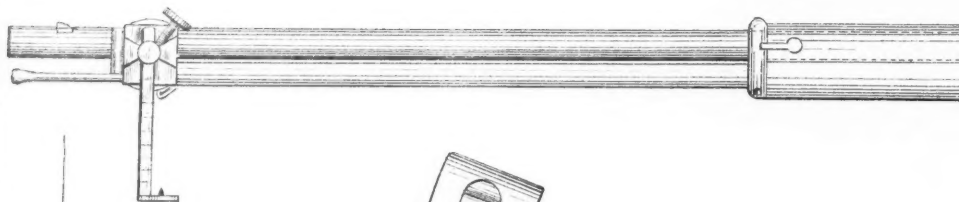
To the revolver succeeded a rifle carrying an endless chain of chambers which could be made to include any number from 10 to 20; each of these was brought by the action of the gun in line with the barrel, secured there and fired, when it was immediately replaced by another, and so on till the entire chain was exhausted. We had also the proposition that a number of charges should be loaded into the same barrel, which carried a nipple opposite the space to be occupied by the powder in each. A lock sliding along the side of the gun was then to fire them in succession, beginning, of course, with that nearest the muzzle. Soon after this, however, they began to be put into a really practical form. Now followed the Spencer, Ball and Lamson, Winchester, Henry-Winchester, Vetterli, Krag, Kropatchek, Burton, Hotchkiss, Green, and a vast number of others, with some of which you are doubtless familiar, and a host more which have barely got beyond the stage of Patent Office specifications. Some are already obsolete, some still claim attention, but all may be divided into three general classes, according to the position of the store of cartridges, and whether or not this forms an integral part of the weapon, for it is fair, I think, to consider a rifle, when provided with an automatic quick loader, as a repeater, such devices as the Krnka holding a place of their own.

Now the older forms of magazine-gun carried their cartridges either in a tube occupying a position in the stock of the rifle, as the Spencer; or one under the barrel, as the Winchester; and this arrangement has been pretty generally followed. The limited length of the stock, however, kept down the number of cartridges which could be arranged in it longitudinally, and in order to carry a reasonable number, recourse was had to diminishing the charge of powder and shortening the bullet to an extent which fatally impaired the range and utility of the arm.

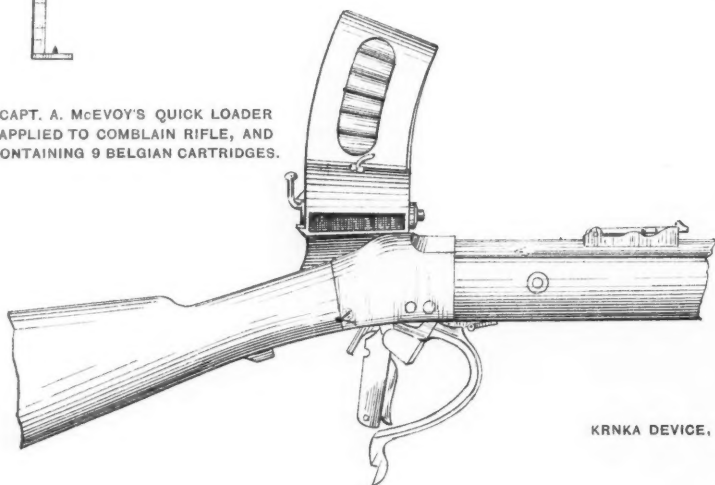
Under the barrel it is true there was space for a larger number, but this involved space for a longer spring, and in the case of the Winchester also, the power of the cartridge was much diminished. Moreover, it has been found that in neither of these positions do more than seven or eight cartridges, impelled by a spring, work very satisfactorily. Again, in some of these arms the mechanism is, from its nature, of such a character, that a full-powered cartridge, such as that of the Martini, would run the risk of unduly straining it, though with the weak charges employed there is but little danger. Both these classes of gun have, however, a serious objection, for which no remedy is possible, viz., that as the magazine is emptied, not only is the weight of the arm altered, as must of course be the case in all repeaters, but the position of the centre of gravity is changed by each succeeding shot, and consequently, what is known as the balance of the gun is never twice the same. Now in the very rapid shooting for which these guns are intended, this becomes a very serious matter;



NEW GOVERNMENT 40 BORE M.

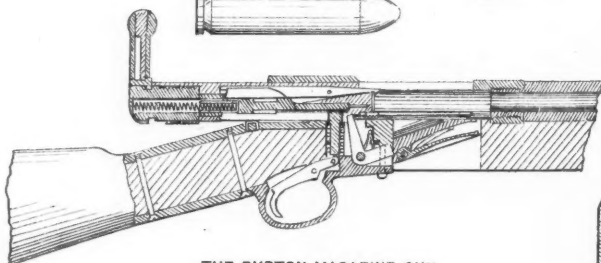


CAPT. A. McEVOY'S QUICK LOADER  
APPLIED TO COMBLAIN RIFLE, AND  
CONTAINING 9 BELGIAN CARTRIDGES.



KRNKA DEVICE, CONTAINING 8 R

BURTON CARTRIDGE.

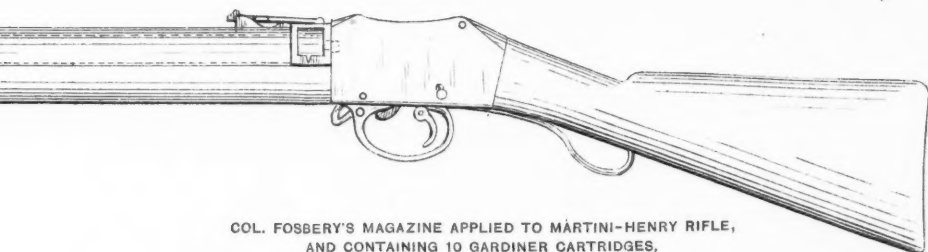


THE BURTON MAGAZINE GUN,

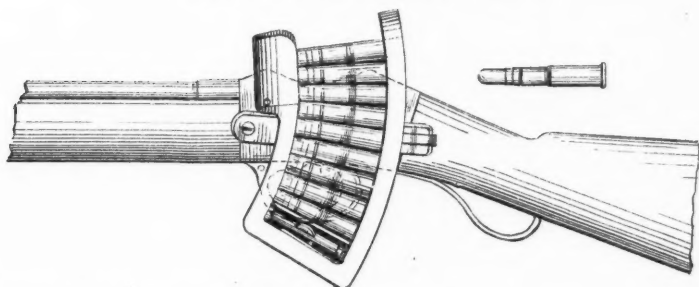


BURTON  
CARTRIDGE  
BOX  
AND  
SIDE  
MAGAZINE,  
CONTAINING  
12 ROUNDS.

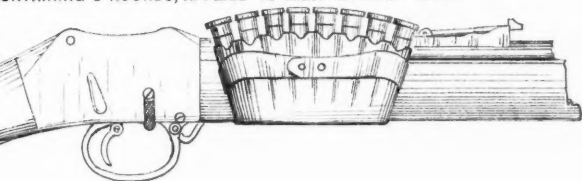
0 BORE MARTINI-ENFIELD RIFLE.



COL. FOSBERY'S MAGAZINE APPLIED TO MARTINI-HENRY RIFLE,  
AND CONTAINING 10 GARDINER CARTRIDGES.



CONTAINING 8 ROUNDS, APPLIED TO MARTINI-HENRY RIFLE.



ON  
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DEELEY-EDGE MAGAZINE GUN, CONTAINING 4 ROUNDS.



and I have heard it asserted that it is next to impossible to make good quick shooting with them at any distance, for this reason.

Sportsmen will at once perceive the full difficulty of this. They all know the value of a perfectly balanced gun, and how much one that is not so takes from the pleasure as well as the accuracy of shooting. What must it be then to have a gun which is always changing in this respect?

The evil still exists, though in a less degree, when the magazine is in the stock, and only disappears in cases where the magazine is placed near the centre of gravity, and where, as in the Lee gun, the cartridges are placed one above the other, in the various forms of attachable magazine, in the Krnka device, and in the new Ward-Burton gun, of which I have here a drawing, and which I had hopes of being able to show you to-day. The inventor is, however, just now abroad, whether at Paris, Berlin, or Vienna, I am unable to say, and all that I can do is to explain the drawing which you see here.

The gun, as you see, is a bolt-gun, a type of weapon against which there has long existed in England a prejudice shared with us by no Power in Europe, and which had its origin in the days when the details on which safety depends had not been sufficiently considered, and the manufacture of the caps for central-fire cartridges was less understood than it is now. In this gun the arrangements to prevent accident or premature explosion are so perfect that no mechanic would, on these grounds, hesitate to approve it; and it was long considered one of the best of its type in existence before it was converted into a repeater.

The first change made was to supply it with a tube under the barrel, from which an elevator, much like that of the Vetterli, raised the cartridges in succession and placed them in a position to be forced forward into the chamber by the bolt.

The inventor next added a supplementary magazine on the side of the gun, and by drawing on his two magazines in succession, was able to fire a very considerable number of shots without reloading; he has now, I believe, abandoned the tube and relies on the side magazine alone—a most important improvement.

A bolt-gun has this notable advantage when combined with a magazine or quick loader, viz., that all the motions are *positive*, i.e., that the cartridges when dropped into the trough or placed in it by mechanical means are pushed forward into the chamber by the act of closing the breech, and the empty shells are withdrawn to their full length by the act of opening it; operations which in other cases must be performed by some separate contrivance. For this reason all the machine-guns of modern type have the bolt or plunger action, their inventors finding this method of dealing with the cartridge essential to the mechanical precision they cannot dispense with.

It is true that in the infantry weapons of this class the empty shell has, as a rule, to be thrown out of the trough by tilting the gun or otherwise; but the device which gets over this difficulty is so simple, consisting as it does of a little stud or a bolt, and so certain in its action that it can be easily made to improve, without complicating, the

weapon. One of Herr Mauser's latest patents was for the application of such a plan to the German arm, which he has also succeeded in converting into a magazine-gun by a tube under the barrel.

Mr. Burton's plan is a very simple and effective one, and in many trials I have never found it fail. He has, perhaps, in his desire to make his cartridges pack conveniently and work smoothly, and certainly, in the magazine, gone a step further than all will be prepared to follow him, in abolishing the rim and substituting a groove at the base to give a hold to the extractor, for he is now obliged to depend on the form of his cartridge and chamber for a proper resistance to the blow of the striker: whether he will succeed or not, when his arms are made in large quantities and perhaps a little less carefully chambered, remains to be seen, but hitherto the support of the rim has been considered essential. The great point about this weapon as a magazine arm for infantry is, however, this, and holds good whether or not he adheres to the new form of cartridge, that whereas in other plans the magazines must be filled cartridge by cartridge, and in most cases against the pressure of a spring and through a trap-door, his ammunition may be emptied into the receiver, and is fed into the gun by its own weight; and, further, that the upper part of the magazine is so constructed as to admit of the small card or metal boxes in which he proposes to carry his cartridges being attached to it full and thrown away and replaced when empty.

He thus gains all the advantages of the Krnka together with the mechanical feed of a true magazine-gun.

This little carbine which I have here shows the action of the Burton rifle as a single-loader, and has fired over 2,000 rounds without failure in a single set of experiments.

You will observe that instead of depending on a single bearing-surface to resist the force of the explosion, he uses the cut-screw, on which depends the safety of all our modern breech-loading ordnance.

The addition of the magazine involves the addition of so few parts, and these are so strong and so simple, that I think the weapon deserves very high commendation for infantry purposes.

For cavalry, a weapon containing a larger supply of ammunition than does his magazine alone would probably be found more suitable.

I have thus described a type of magazine-gun carrying its cartridges in the position which, in my opinion, they should occupy, viz., close to the centre of gravity of the arm.

The Winchester, or more properly Henry-Winchester, and Kropatchek rifles, both of which are familiar to you, are of the class which places them under the barrel, as are the Vetterli, the new Italian gun, and several others.

This little Kennedy rifle, lent by Mr. P. Webley, of Birmingham, and very similar in appearance to the Winchester, is, however, less known, and may be interesting from the perfect way in which it works, and from the ingenious manner in which the space behind the cartridge is solidly filled up at the moment of firing, enabling the gun to use a far more powerful cartridge than others of its type, of which nevertheless its makers do not seem to have

taken advantage. Personally I should be disposed to rate it more highly than the Winchester as a carbine, but like most of its class it is in principle unsuitable for infantry purposes. All these guns have this great disadvantage, that not only is the balance perpetually changing, but it changes in the wrong direction, supposing us to be firing, as would naturally be the case, at an advancing enemy. For when the magazine is full, there is a considerable muzzle preponderance, which each succeeding shot diminishes, thus having a tendency to give the gun more and more elevation the nearer the enemy approaches.

The contrary is the case in those repeaters which carry the ammunition in the stock, though the small number usually so carried, and their comparative nearness to the centre of gravity, makes this of less importance, except, indeed, in such a case as that of the Evans gun, which is said to carry some 20 cartridges in the butt, a number, as I believe, greatly in excess of what should ever be attached to any gun. A good specimen of this class is the Hotchkiss repeater, which competed most favourably with the Kropatchek, and came very near being adopted by the French for use in the Marine, and which, it is generally believed, is likely to be taken up in the United States, where, however, the Ward-Burton has also been most favourably reported upon.

Again, we have the new Deeley-Edge repeater, of which this is a drawing; there is nothing new in the arrangement of the cartridges which occupy the tube here shown; but to those who distrust all bolt-guns the security of this falling block is rather captivating, and the smoothness of the action and perfection of the workmanship and finish make it a formidable competitor to most of the other systems. It carries full-powered cartridges, and may be relied on to make perfect shooting, the only pity is that it does not carry more of them. Its inventors are, however, at work on a new weapon, carrying a centrally placed magazine, and if it only fulfils the promise given by this first specimen, I think we may look forward to having such a repeater as will satisfy both those who call for a larger supply of ammunition and those who consider no action reliable that does not depend on some form of block or wedge.

In this class also we hear most favourable accounts of a new Swedish rifle, the Jarman. But as yet, no one in England, I believe, has seen it. Like the Ward-Burton, in its condition of single-loader, it had the reputation of being one of the best of the bolt-guns for strength and efficiency. In simplicity and fewness of parts it is said somewhat to resemble the famous Pieri gun, which has excited so much attention and met with so little success, except that M. Jarman does not use the impracticable upper trigger of the Pieri, but discharges his weapon in the usual way, and that, like Mr. Burton, he has two rear-bearings for his bolt instead of one, as is the usual Continental practice.

He is now converting this simple bolt-gun into a repeater, though should he finally decide, as I hear he has done, to carry his ammunition in the stock in the ordinary way, I fear that, as with the Hotchkiss and some others, the supply will not be considered sufficient when the

various systems of magazine-gun come to compete for general adoption. It will then, I feel sure, be found that the full advantages these arms offer, whether for attack or defence, cannot be secured with less than 10 full-powered cartridges when the gun is loaded and the magazine full, and it will be a serious mistake to be satisfied with less.

But if Mr. Evans gets his 20 rounds into the butt, as they say he does, there can be no reason whatever why others should not do the half of it; it is merely a question of arrangement that may be easily and simply solved.

The last of these weapons of the magazine type that I have to show you this afternoon is the Green gun, and it is very peculiar, as well as ingenious, partaking largely as it does of the character of the revolver, and being yet a full-powered five-shot repeater. The chamber you see here contains a spindle, to which are attached five leaves, between which are placed the five cartridges. The bolt now pushes forward one of these, and after firing withdraws and ejects the empty shell, and then, literally turning over a new leaf, fires and extracts the second, and so on, till all are finished; when the case is opened, and the magazine refilled. This, like so many of these arms, is an American invention.

We now come to the compromises of which I spoke in the early part of this lecture, as designed to tide over the period which must elapse before a complete re-armament can be made by such Powers as choose to adopt the repeaters; to take their place with such as either shrink from their cost or dread their complications; and to utilize for all of them the vast stores of weapons which it is impossible to convert, and with which, in their present state, it would be cruel to arm the second line, were the first, to say nothing of their enemies, to carry the repeater.

These, like the repeaters themselves, may be divided into three classes.

The first would be such as, like the Krnka, merely place the cartridges in a position more favourable for quick loading than the soldier's pouch. The second, such as require some operation to be done on them before they deliver their cartridges. The third, such as, connecting themselves with the mechanism of the gun, follow its movements, and place the new cartridge in the place of the empty shell just withdrawn. Captain James on a former occasion was able to show you the Krnka; as he explained to you it consists of an attachment secured to the rifle, in which are placed one after another the cases in which the ammunition is carried, and which are thrown away when done with. To the second class belongs this simple contrivance, the invention of Captain McEvoy, so well known for his system of defensive torpedoes. It consists of a thin steel case, which contains some nine rounds of cartridge. It can be attached to or detached from the gun in an instant, and when in use may either be operated by hand or by a simple attachment to the mechanism of the gun.

As you see it here, it is attached to the Belgian Comblain rifle, and contributes greatly to its rapidity of fire; in fact, makes what is rather a slow gun among modern weapons far more rapid than any unassisted single-loader.

To the third class belongs the Lœwe adapted for use with the Mauser rifle, for which it was mainly designed. The cartridges are placed in a semicircular box, which contains a spring, against which they are forced in until the box is full. The action of the rifle, by releasing certain catches, allows them to escape one by one, and they are sent forward by the action of the bolt, fired and extracted as usual. The German Government had this invention under consideration for a considerable time, and, I believe, made a large experimental issue to the troops. As far as I can learn, the advantages were not found to outweigh the expense and complication, and the matter is at present in abeyance.

Should nothing better offer, there are many circumstances under which the Lœwe might prove formidable enough.

Of these three plans the Krnka and McEvoy quick loaders may be successfully applied to almost every known form of rifle. The Lœwe could with modification be probably adapted to the Mauser, Gras, and Berdan guns, *i.e.*, to the arms of Germany, France, and Russia.

Our own rifle, however, presents several formidable difficulties to the adaptation of any quick loader, which shall be automatic, and at the same time simple and inexpensive. Several attempts have been made with this object, one of which, by Mr. Perry, the manager at Enfield, I have seen tested. It contains 10 rounds, of which 7 are contained in one compartment, and forced upwards by a spring; 3 occupy the other, and descend by gravity. As fast as each is dropped into the trough of the gun, it is taken charge of by an independent plunger, and sent into the chamber, when the gun is closed and fired as usual. It is impossible without drawings to give an idea of this extremely ingenious attachment, but its rapidity may be imagined when we know that 10 rounds have been fired with it in 9 seconds. It, however, contains a very large number of parts, which require great nicety of adjustment, and would probably cost more to manufacture than the difference in price between an ordinary single-loader and a repeater. Several other plans have been devised for the same purpose, some by other employés of the Government, and some five or six are now under consideration.

My own contribution to the list is here attached to a Martini-Henry rifle, chambered for the old bottle-shaped cartridge, and as it will contain 11 of them, it looks cumbersome and clumsy, though it in no way interferes with the working of the rifle. It has, however, the merit of being cheap and simple, and is not likely to be put out of order, and as you will see does its work fairly enough.

This little case shows you the same invention, made to contain nine of the new Gatling or Gardiner cartridges, which, with one in the chamber, makes up the ten I consider should be carried by every magazine-arm.

It can also be made considerably lighter, though the one I have here only weighs as much as eight rounds, and I am now engaged in fitting it both to the Mauser and Roumanian rifles, the latter of which carries the Gardiner cartridge, and the Mauser one considerably smaller, and to one or two other weapons.

You will see that I dispense with springs, and by this means get great facility of recharging, and at the same time a positive mechanical movement, which ensures the regular delivery of the cartridges. I have endeavoured in producing this magazine to strike a point midway between such devices as are too simple to effect all that is required, and those which, aiming at an unnecessary degree of completeness, only obtain it at great cost, and at the expense of mechanical complication. For instance, nothing is easier than to cause the cartridge to be forced home into the chamber by means of a moving plunger; but except in one case, where I have been requested to do so, I have hesitated to introduce a second spring and three other pieces. Of course the Mauser and other bolt-guns dispense with anything beyond what you see here.

The new cartridge which, with a new rifle for its use, is now in course of experimental issue by the Government, materially reduces the size of such contrivances, and would seem to be peculiarly adapted to a magazine-gun, or magazine attachment. I am able, by the kindness of the War Office authorities, to give a slight sketch and description of this new weapon, some 60 of which have been lately manufactured, and are now issued to both troops and training ships for trial, and which I have been permitted to see.

The rifle which you see roughly represented here differs in appearance, to a certain extent, from the arms to which we are accustomed, and largely exceeds them both in accuracy and power, while arrangements for enabling it to be used with effect at the longer distances have been carried out in a way that entirely obviates the inconvenience of those tall ladder-like sights we see on foreign arms. These bring the butt of the rifle so low upon the shoulder as in a great measure to destroy the accuracy of the practice; and it is mainly, I think, from their use that we find the foreign mass shooting to be so barren of results.

In this rifle the arrangement is reversed. This little vertical bar, depending from an attachment on the upper band, carries a cross-piece, which, when in position, stands out horizontally and carries a small foresight at its centre, and the rectangle formed by the long vertical and short horizontal parts form an admirable guide to the eye for keeping the rifle upright.

This small vertically-hinged flap opening out from the side of the gun forms the hindsight. In using this combination and shooting at 2,000 yards, the soldier will be able to keep the butt of his rifle even higher on the shoulder than he does at present when firing at 100 yards, thereby ensuring his steadiness, and avoiding the awkward recoil which in the other case always accompanies practice at extreme ranges.

A wooden hand-guard, easily removable either by slackening the lower band or by pressing the spring clips, protects the fingers from being burned by the barrel in quick firing and in tropical climates, and enables the soldier at all times to get that firm grip of his gun which is so necessary to good shooting.

The wood, as you see, between the lower and upper bands has been

cut away so as not to bear on the under side of the barrel; thus, while it is firmly held and supported at the places necessary to ensure good shooting, it is secured against the danger of being distorted as sometimes happens when the bands are screwed up tight, and the stock slightly warped or swelled by long exposure to damp or rain. Furthermore, the rust which often seriously damaged our arms on foreign stations at this part can no longer be formed unseen.

I should add that on the upper part of the rifle just in front of the action is a short broad sight of great strength as well as delicacy, suited for all distances up to 1,000 yards, and that the bar foresight which can be attached or detached in a moment is only used beyond that distance.

The barrel is, I may add, about 6 oz. heavier than that at present used, which is the only difference in the weight of the rifle, the other changes balancing one another; but this is more than compensated by the new ammunition, 70 rounds of which are about  $11\frac{3}{4}$  oz. lighter than 70 rounds of that now in use. The extra weight of barrel diminishes recoil and gives steadiness and strength just where it was required, and is, I consider, an unmixed advantage.

We will now proceed to the interior description of the weapon—the cartridge—and the results they are capable of producing. For a great departure has been initiated in these respects. In the first place we have, I hope for good, abandoned the Henry rifling, which, excellent as it was as compared with some of those best known when it was first adopted, has as yet never been equal to the Metford, the Rigby, or the American forms of grooving; it is difficult and expensive to cut, favours heavy fouling, and increases recoil. In the new rifle a fine ratchet rifling of 9 grooves, and a complete turn in about 15 inches, has been substituted.

The cartridge is trumpet-shaped rather than bottle-shaped; the bore has been reduced to .40, and the bullet from 480 to 384 grains; the powder charge remaining the same (85 grains).

Under these conditions, we have an enormously increased muzzle velocity amounting to as much as 1,570 feet per second, the Martini having about 1,290, and of course for the shorter ranges a proportionally flattened trajectory.

As to accuracy, every shot at 500 yards will strike a plate 10 inches square, and the only fear we should have at first sight would be, that at the longer ranges we should lose (owing to the diminished weight of lead) that striking power so formidable in the Martini-Henry. This is, however, by no means the case, for up to 3,000 yards the lighter bullet strikes the heavier blow, and will of course, from its smaller area, have the greater penetration.

The striking force of the two is at the muzzle, for the new rifle 1,670 foot pounds as against 1,302 of the Martini, at 1,000 yards, 350 to 332, and at 3,000 yards, 44 to 40.

Had the new rifles been all issued, I should have been permitted to have shown you one at this lecture, and given you the full particulars of its performances, which are very remarkable. As it is, I am confined to the few details I have now given, and must refer you for

full information to the printed papers, which are sent out with the arms themselves.

In any case, even from what I have said, you will see how great an advance has been made on our present armament, which, notwithstanding, excels anything in use in Europe. The matured experience, high scientific attainments, and mechanical ability at the command of our departments and factories, supplemented by exhaustive experiments, have brought the barrel and cartridge to what is, for war purposes, as near absolute perfection as is ever likely to be seen in our days in a military arm.

The object of this lecture has been to prove the possibility and enforce the necessity of getting that cartridge in and out of that barrel more quickly than is done by the means we adopt at present.

This can be done in one of two ways: either by abandoning the Martini action altogether, or by attaching to it some form of magazine to be carried separately from the arm, and fixed on it occasionally as we fix a bayonet, for the Martini action, from its nature, permits neither the use of a reserve in the stock, nor of one under the barrel.

The one plan involves the perfecting of an entirely new action, and will necessitate eventually the sacrifice of the hundreds of thousands of arms we now possess.

The other, at a tenth of the cost and in a tenth of the time, would arm the whole of our troops, both line and militia (the latter now carrying the Martini-Henry), with the quickest as well as the best weapon in Europe, and place us at once far beyond every Power in Europe for a number of years.

At a moment when all are contemplating a change, and we ourselves have just perfected so remarkable a combination of barrel and cartridge, it behoves us, I think, to pause before committing ourselves to a perpetuation of the single-loader, which, if now issued in great numbers to our troops, will shortly leave us behind those other Powers of Europe which shall adopt the repeater, or force us into fresh changes, and that perhaps at a time when we shall find ourselves in a situation less favourable than the present for making it.

In the short space of a lecture like this, it is difficult to do more than indicate possibilities and give a definite direction to the thoughts and opinions on which our conclusions must eventually be based—my purpose, however, will have been fulfilled should I have succeeded this afternoon in doing this in ever so small a degree. In conclusion, you will perhaps allow me to thank you for your presence at a lecture which treats on a subject so technical as mine, and for your kindness in so patiently following me to the end.

The CHAIRMAN: Now, having heard this very interesting lecture, it is hoped that gentlemen present will offer some remarks upon this subject; and I have to observe that although, as yet, we have not got the *clôture* in action in the House of Commons, we have long had here a ten minutes' gag, of which I must remind you.

Captain W. ARTHUR, C.B., R.N.: Perhaps it would not be uninteresting to those now present if I said a few words as to what is being done in the United States respecting magazine rifles, and I can assure you that they there fully realize

its value, and concur with Colonel Fosbery that it is the weapon of the future. Shortly before leaving New York in February last I saw a new pattern magazine rifle designed by Spencer, but then unfinished. This was on quite a different system from the old Spencer repeating rifle, and comes more under the category of those classed as No. 2 system by Colonel Fosbery, differing in having the reservoir underneath the breech instead of over, on what is called the Lee system, in which the cartridges are packed in a tin case, which can easily be attached to the gun, and when empty replaced. A military Board has been sitting since February last on this subject, and they do not expect to send in their report until June next. I have just received a letter from a correspondent at New York, who I may add is interested in the Spencer. He states as follows:—"Some twelve or fifteen different designs of repeater have been entered, a very small number for a nation prolific of inventions, and I confess to my own surprise at this as well as at the lack of novelty evident in the generality of designs. With but two exceptions, I believe, all of the arms are on the bolt principle. The Spencer has, however, freshness of conception enough to more than save the credit of the country; I think you will agree with me in this. We entered the rifle some four weeks since; its record in the firing test was extraordinary. Used as a single-shot breech-loader in the hands of the armourer, who fired it for the first time, it easily delivered twenty-seven shots in a minute. In the two-minute test for rapidity with aiming, Spencer himself fired it, the target being 100 feet off; he delivered sixty-four shots in two minutes, of which fifty-six were counted within a centre of small radius. All of the other tests were encountered with equal brilliancy of success, except the rust test; this is an absurd test, the gun, being cleaned and dry, is dipped in sal ammoniac fifteen minutes, and then exposed to the open air for forty-eight hours. In most instances the air had been so charged with humidity that the solution did not set at all, but stood as a lubricant. In our case there was a cold dry wind, and the rust was excessive, the members of the Board saying that no previous arm had been so severely treated by the test. I do not think the circumstances would have been considered adversely by the Board, but we concluded to withdraw the piece and put in a new one. The new rifle will have less frictional surface, and, Spencer says, will, using it with the magazine (the Lee), deliver eighty shots in two minutes. It will be ready in little more than a fortnight." Although foreign to the subject under discussion, I might mention that Spencer has also brought out a magazine fowling-piece, firing the ordinary sporting cartridges. It has one barrel, carries five cartridges in the magazine in addition to the one in the chamber, and only weighs 7 lbs. 4 oz. In February last I fired it for the first time, having handled the piece only once before; I then broke with it in five seconds six glass bottles thrown rapidly up in the air.

Admiral H. BOYS: This is as important a question to the Navy as it is to the Army, and having been connected with the Machine-Gun Committee, which dealt with the subject of magazine rifles, I may be permitted to make a few remarks. The conditions as to the requirements for the Army, which Colonel Fosbery mentioned just now, in regard to the time occupied in a final rush at the last stage of an attack, are precisely the same as those for the Navy, principally in the case of a torpedo-boat attack. Probably the torpedo-boat passes the ship at a very high rate of speed, and is within effective range only two or three minutes, and then is the moment we want extreme rapidity of fire; then is the time that a magazine arm of some description becomes an absolute necessity. The French have already adopted for their Navy a magazine rifle; I do not know if the Americans have yet introduced one, but I believe a pattern is under consideration. In the event of a magazine rifle being adopted, one of the first considerations should be that both the Army and Navy should have the same description of weapon, on account of the supply, &c., on foreign stations, and it is a *sine quâ non* that the magazine rifle should take the same ammunition as the Service rifle. Colonel Fosbery has given a description of several magazine rifles. Probably he is not aware of an incident in regard to one description, which is of considerable importance. It is that arm in which the magazine is underneath and along the barrel. In one of our early experiments at Woolwich, while firing for rapidity, the recoil of firing exploded one of the cartridges in the magazine, shattering the man's hand who was firing and

disabling the rifle. A series of experiments were subsequently carried out to test this, and, although we did not explode the cartridge in the same way again, it was found that in most of the cartridges in the magazine that had been subjected to frequent recoils from firing or from the rifle falling on a hard substance, the point of the bullet took more or less the impression of the cap of the cartridge in front of it, showing that it had received a considerable blow. Chemists tell us that it is impossible in manufacture to construct caps of exactly the same degree of sensitiveness, especially if exposed to variations of temperature and deterioration from age. From this circumstance it was decided to abandon all arms that carried in their magazine the bullet of one cartridge against the base of another, as involving the risk of accident that was avoidable, and this of course cleared away many excellent weapons that might otherwise have stood a good chance of recommendation. With reference to quick loaders, there is a very simple one, the invention of Captain Mayhew of the 23rd Regiment. It is made of two pieces of leather sewn together, like an ordinary sporting cartridge holder. It contains ten cartridges. One man carries three. One can be attached to the rifle by means of buttons or held by the fingers of the left hand on the right side of the barrel. On a trial I think we were enabled to fire forty-four rounds instead of thirty-four rounds in the ordinary method in two minutes. It was recommended for further trial. I have not since heard further particulars, except that for land service the gain in rapidity was not thought sufficient to warrant a change. In any new description of quick loader I think it would be desirable that cartridges should be issued in the contrivance that may be employed, as having to charge a quick loader with cartridges from paper packages in action, either in the field, on board ship, or in boats would be very objectionable. Time does not admit of further remark, except that we must all feel indebted to Colonel Fosbery for his interesting paper.

Admiral SELWYN: My Lord, Ladies, and Gentlemen, I have for a long time been a consistent advocate of the magazine-gun known as the Winchester, or the Winchester-Henry, as it is also called: for there is a gentleman of the name of Henry who has been connected with it. I was surprised to hear from Admiral Boys that there was a case in which a cartridge of the Winchester system exploded during the Committee's experiments. I should say in answer to that that more than 100,000,000 of Winchester cartridges have been fired without anything occurring of the kind: and my knowledge of the subject shows me how alone such an explosion would be produced. Therefore, if 100,000,000 cartridges have been fired and only one such accident has occurred, I should look closely at the possibility of doing it on purpose in order to discredit that particular system. I do not reproach anybody; I only say it could not have been done in any ordinary way; it is impossible to do it if the cartridge is properly capped. The cap is always below the base of the cartridge, the bullet is flattened at the end, and the lead has not sufficient resistance to imprint the whole of the base of the cartridge. I saw personally in Turkey during the war the Circassian cavalry all armed with the Winchester-Henry carbine. My friend Reouf Pasha is a noble specimen of the Turkish Pasha as he really is, and not as his detractors describe him, Tall, elegant, dark-eyed, intelligent and humane, a perfect gentleman and a splendid soldier, an affectionate father and a beloved chief—I wish we had many like him here. At Yeni Zahrah during the war he told me that he was reconnoitring with only his personal body-guard of some thirty Circassians. A Cossack regiment, some 600 strong, came down and surrounded him. It was towards nightfall; he got his Circassian guard off their horses and made them all lie down, they and their horses. He said to them: "Now, my children, we are in a mess, and must sell ourselves dearly to the Ruski." The Cossacks formed around them, thinking they had only to prevent their escape, but in five minutes so many of the Cossacks were killed, not one of the Circassians being touched, that the Cossacks decided to leave them alone and to go away. That shows the value of magazine weapons. It also shows a fact that I think should be duly weighed in considering the weight of balance of the gun: that we shall scarcely use the magazine-gun unless in some position that will help us to support the unbalanced weight. No one will think of using his magazine for rapid fire at 5,000 yards or even at 500, but in close action at 100 or 200 or less, and at that distance he will have the means of supporting it in either the kneeling or re-

cumbent position, or on the turf of the intrenchment; so that I do not attach so much importance to the balance of the gun, as many seem to do, particularly in the case of the Winchester or other magazine-guns in which it is rarely necessary to use the magazine owing to the rapidity with which the cartridge can be inserted at the side, and which is amply sufficient for all ordinary occasions. Next I would say, that in the proposed magazine adjuncts to the ordinary rifle, the number of cartridges which are carried above the rifle and not over the centre of the axis is objectionable in a remarkable degree. They put a pound weight (for there are ten cartridges) at one side of the barrel, and yet it is absolutely necessary to keep the axis of the gun vertical; but in proportion to your magazine fire you are liable to alter the verticality of the piece, which is a far more important error than mere balance; therefore I do not like that system. It also adds to the weights and articles the soldier has to carry. Colonel Fosbery has shown us how to do the same thing underneath, but even there it has the objection that there is a serious obstacle in handling and moving the rifle itself. You cannot move through or over difficult ground with the case hanging underneath. I am quite willing to accede to the suggestion, that as it will take a long time to choose and manufacture a thoroughly good magazine-gun such as we have not at present, it will be necessary to have something that would be a stop-gap in the meantime, and I hope that the best one that can be invented will be used, but only in the sense of a temporary measure. But the main question is that touched upon by Admiral Boys, that there should not be two natures of cartridges at all, either in the Army or Navy; and I distinctly affirm that if we start in our investigation of a magazine-gun—with the gun and not with the cartridge—we shall come to grief over the investigation. We have made all sorts of unpractical cartridges, and we are now to make another unpractical cartridge. I call that an unpractical cartridge which destroys uniformity. Cartridges which have trumpet shapes are not cartridges which easily preserve their horizontality in a magazine arm. They are the reverse. Cartridges which have light and small bullets and a calibre of .400 of an inch are not those that most people would seek for any mitrailleuse. Their penetration due to velocity may be very great: but although that is the case, there is but little shock to the system, there is no stopping of the ugly forward rush either with cavalry or tigers. You know that in India among sportsmen the small-bore is utterly useless. I have seen letters over and over again from sportsmen, showing why they found that weight of bullet was absolutely necessary. You may shoot all the magazine of a carbine into a wild beast but you cannot stop it—a tiger especially. Now, cavalry cannot easily be stopped by the rifle whose penetration has enabled the small and light bullet to pass through without shattering. As we saw in the American War, it passes through the bones without breaking them, and the cavalry goes on. I only urge these things as points that ought to be considered before we settle the cartridge. Having settled the best cartridge for all purposes, let us go on to the magazine rifle. Let us recollect that with the question of the cartridge must be included the length of the cartridge. If you have a magazine-gun, you must necessarily, in almost all forms of the magazine-gun, be limited in the number of cartridges by the length of the cartridge. If you make a long cartridge you will have very few of them. Next, in the placing of the store of cartridges in the magazine-gun, it is considered that the most useless weight we carry lies in the weight of the stock, and for this useless weight useful cartridges might be substituted at the rate of ten to the pound. In the Hotchkiss repeater in the carbine form there are twenty-seven cartridges carried in the stock by means of a very clever adaptation of the Archimedean screw. A simple rotating receptacle is made by a skeleton spiral triple groove with a shaft in the centre, in which the cartridges lie nine on each side, not necessarily occupying more than the thickness of the stock. With those cartridges on the table which Colonel Fosbery has shown, I think that could be done with the full-sized infantry arm. Now, if we are to consider what weight of lead we are to allow to each cartridge in view of the total weight a soldier can carry, it is quite clear we cannot make our magazine arm at all; that is to say, we cannot calculate any part of it without having the cartridge before us; and I do say that those who consider this question must first consider the lead, then the kind and weight of powder, and, lastly, consider the shape and weight, &c., of the cartridge case. Au

important change in the weight of ammunition has been made by adopting a simple case instead of a complicated one—a case which does not contain brown paper and two or three pieces which are utterly unnecessary—but is simply a solid drawn cartridge case. Adopting that case is an enormous advantage which might have equally been had before, had the cartridge only been sufficiently studied in the first instance; but it was not so studied, and the nation has paid heavily and uselessly in consequence. With regard to the sight in the new proposed Government gun, I would say that, twenty-eight years ago, I did the same thing and showed it to this Institution in a different way that would, I venture to think, recommend itself by its superior simplicity. There is no patent for it. We do not want attachments on our infantry rifles; we do not even want little bits to be put on and taken off; if little adaptations *are* necessary, all we want is that they should be as small and simple as possible. By the mere use of a prism no bigger than the thumb-nail slipped on to the ordinary back-sight of a rifle, we gain all the advantages of that attachment, and we do not have to raise the cheek from the butt, at any elevation or range, no matter how great, we ensure also perfect verticality. With regard to the grooving of the rifle, we have discussed that very often in this Institution. It has been shown, unmistakably, that too much value for military purposes has been attached to the inner groove of the Henry rifle. It has been shown that all forms of groove are good provided they are not too deep. Our old friend the Enfield, with its shallow and simple grooving, gave good results for its charge and calibre. It is desirable that the rifle should not be such that, in cleaning it rapidly, the bottoms of the grooves cannot be reached. It is desirable that the bottoms of the grooves should be reached. Now, that is not the case in any form of deep grooving. No man can tell beforehand on what day fouling will take place, or what weather will produce it, and in any system like the Martini-Henry with rapid firing it will destroy your chance of accuracy altogether. No one knows how it occurs, under what condition of atmosphere or otherwise; but it is more readily got out when the grooving is simple. I must rather protest against the Vetterli arm being spoken of as an original idea in magazine arms. The Winchester-Henry was taken to Switzerland. The Swiss adopted the bolt system from the French Chassepôt and stuck it on to the Winchester-Henry, thereby spoiling the simple arm which is the favourite of all sportsmen and of light troops all over the world, with which every man who goes out to shoot or be shot by Indians in America is armed, and which has proved itself, beyond doubt, to be thoroughly reliable. Major Serpa Pinto, the last explorer in Africa, speaks of his Winchester gun in the highest terms. Wherever you see a Winchester gun, the man who has it is pleased with it, with the sole exception of its charge being considered too light for infantry; but it is wrong to suppose that in the Winchester you cannot support any charge that is required. It is more solid than the bolt. If you take Captain Burton's or any other bolt-gun, and measure the shearing force requisite to drive the bolt clean out, you will find it is considerably less than the force necessary to double up any joint of the Winchester-Henry. I have no interest in the gun further than a scientific one from seeing it used. There is only one more thing that I should desire to notice, and that is, that we are changing very materially our relative proportions of bullet and powder in the new proposals. We are getting possibly a lighter bullet and a smaller powder-charge, and we are getting a lighter cartridge, partly in consequence of that and partly in consequence of the simple metallic cartridge, which, other things being equal, would be highly desirable; but a powder-charge that answers in that way will not always answer in another. We shall find we are violating certain principles very well laid down and very closely followed out, which are giving, if not the best results, yet very good ones; we are going back again and disturbing weights of powder and lead which are supposed to be settled. If that is to be, why do we not have exhaustive experiments on the cartridge? If we had, we should be more likely to succeed, having settled that point, in settling the whole question of ammunition and arms for the next hundred years, or until war shall be no more, which would be a still more desirable conclusion to our labours.

The CHAIRMAN: I observe that there is an unwillingness on the part of those present to offer remarks; we have had some very interesting observations made

by those connected with the Navy ; but, looking to the importance of the subject as regards the Army, I hope some of the distinguished soldiers present, Sir Lumley Graham or Colonel Hope for instance, will have a word to say.

Sir LUMLEY GRAHAM : I should like to make a few remarks ; not that I understand much about the technical points of the question, but because one has some ideas about the weapons which should be used in the Service. It is quite evident to me, and I think, from what I hear, to most people in this theatre, that a magazine arm, or something of that kind, must shortly be introduced into our Army ; and that we of all armies ought not to lag behind in getting that weapon, because, as the lecturer has so ably stated, as we generally turn out in inferior numbers to our enemies, it is all the more necessary that we should have a better arm. I gather from what the last speaker said that there are a vast number of points to consider before we can get a perfect magazine arm. We may have to wait as long as the days of Methusaleh until we get that arm, so that at present we should aim at getting the next best thing for the purpose, which seems to me to be some sort of attachment, such as Colonel Fosbery has shown us, and which has been tried on various arms on the Continent. The Krnka is one which I have heard well spoken of. The Loewe has been rejected by the German Army. As to the number of cartridges that can be fired by any rapid firing machine of that sort, it seems to me that we do not require any great number ; that a shooting apparatus of that kind should only be used at the last moment, never at long ranges, nor even at moderate ranges, but at very close quarters just before coming into contact with the enemy ; therefore, I think, if an attachment of that sort enables us to fire ten rounds without ceasing, it ought to be sufficient. The last speaker found fault with one of the attachments shown because it was on the top of the barrel, and would be apt to make the barrel turn over when being fired. I do not think that is a matter of very great consequence, and this need not be considered an objection if it is otherwise a good piece of mechanism, because it would be used at such close quarters : you would be firing into a mass of men without aim, and all you need do is to hold the rifle straight. The lecturer did not say anything of any report having been made as to the durability of these magazine rifles. That is an important point, because it seems there is a little complication in the machinery, and we know complicated things are not generally serviceable in war. I should like to know how the Vetterli rifle, which the last speaker has said is a modification of the Winchester, and which has been in use in the Swiss Army for some ten years, is reported upon. They have not tried it in war, but they have tried it at sham fights, at target practice, and so on. I should like to know if there is any information as to its getting out of order. Then the Winchester was tried in America and Turkey, and we might have reports of that also. With regard to these magazine arms, I am not sure but I suppose that every one of them can be fired as a single shooter.

Colonel FOSBERY : The whole of them.

Sir LUMLEY GRAHAM : Otherwise it would be a disadvantage. I will not take up the time of the meeting any longer.

Lieutenant-Colonel HOPE, V.C. : It is many years since I devoted much study to small arms, and I, therefore, speak with a good deal of diffidence on the subject. The remarks of Admiral Selwyn seem to me to cover almost the whole of the ground. I have a very strong opinion as to the absolute necessity of the adoption of some form of magazine or repeating arm : and I think it is a matter of absolute certainty that it will be introduced in all other countries, and probably, sooner or later, we shall do it ; and I would venture to ask your Lordship to use your influence in the House to endeavour to get a Committee appointed, not to report on the merits of the different weapons, because it is very easy to criticize, but with the responsibility of adopting one. I will just state what happened to myself about twenty-four years ago. Shortly after the Crimean War, I was attached to the Legation at Washington, and it was my duty to report, among other things, on a breech-loading arm invented by a Mr. Morse, of Louisiana. It was nearly the same as the present Springfield of the United States Army. I reported very strongly in its favour, made diagrams, and went into a long argument in favour of breech-loaders as against muzzle-loaders, and I pointed out that although there might be a waste of ammunition, yet, if other nations adopted breech-loaders, we must necessarily do so

also. I was ordered to buy a rifle and a thousand rounds of ammunition, and send them home; which I did. It was referred to the usual Committee, which sat for the usual number of months, and made the usual report. They said it was a very ingenious rifle. I had said that I loaded it under water, plunged it into the River Potomac, opened it in the river, loaded it in the river, and it worked very well: that I had also loaded it on horseback. They said it would do all that; but it was not adapted for the *British Service*, for the three following reasons: 1, it fired too quickly, twelve shots a minute; 2, the cartridges were metallic; 3, they contained the principle of their own ignition. The Committee did not explain why those reasons rendered it inapplicable; they simply stated that because of these three reasons it was not adapted to the British Army. In 1866, after the Austro-German War, I was staying at Malvern, and there came the celebrated War Office advertisement inviting public competition for breech-loading small arms, leaving everything open—the length, weight, calibre, system, and everything—but stating that all competing rifles must comply with three *sine quâ non* conditions: 1, they must fire not less than twelve shots a minute; 2, the cartridges must be metallic; 3, they must contain the principle of their own ignition. With that little experience of my own, I have a great dislike to professional Committees—Departmental Committees, as they are called. They are bad enough if composed of military men only; but I am sure that they are worse if you mix up the Army and Navy together. If the House of Commons take the matter in hand and appoint a scientific Committee, with a few soldiers and sailors to help them, as experts to keep them straight, and with the responsibility of not only making a report, but of adopting an arm, I think a practical result will be obtained.

THE CHAIRMAN: As no other gentleman feels inclined to speak, I would thank, on the part of this meeting, Colonel Fosbery for the very interesting and very comprehensive way in which he has treated this most important subject. In so doing it may be thought, perhaps, impertinent in me after his lecture to say anything; but I should like to make a few remarks before Colonel Fosbery answers the observations that have been made upon his paper. I am very glad to have heard Colonel Hope's very pointed remarks, because he has told us of breech-loading arms existing in America soon after the Crimean War, and of the official objections in this country to their adoption then; but we know that as early as 1848 the revolution in Germany was suppressed at Dresden and Radstadt by the breech-loader; and, if I am not mistaken, it was the same arm that was used by the Germans in the late French War. Colonel Hope further says it was in 1866 that the second official notice to which he referred came out. Now I well remember how at meetings of the National Rifle Association, and before that time, we used to urge the importance of having a breech-loader for the Army; but we were always met with the reply, "Be careful how you ask for breech-loaders; the soldiers will fire away their ammunition too quickly, and then they will be at the mercy of the enemy." This language was then held in the highest military quarters, and used to be endorsed by many able and experienced soldiers. To some of them I used to put this question: "If you were to have the command of an army of 50,000 men with the knowledge that you would have to meet an enemy of 50,000 men, your equal in every respect, and armed with breech-loaders, and if the authorities at home gave you the choice for your troops of muzzle-loaders or breech-loaders, which would you take?" "Oh, in that case I should take the breech-loader." That is exactly the way in which we stand now as regards the repeating arm *versus* the breech-loader. There is not a gentleman on the Small Arms Committee who would not, if the question were thus put to him, say, "If we are to meet foreign troops with repeating rifles, we would in that case arm our troops with a similar arm." I think the whole tone of this discussion has been in favour of taking active and immediate steps to have our soldiers armed with repeating rifles. We have it from Admiral Boys that the French have adopted a repeating arm for their Navy; and, from Colonel Fosbery, that other Governments are likely to adopt magazine rifles. The Swiss we know have long had them, but here, although, as Admiral Boys has told us, a Committee has been considering the subject, all we know is that, as stated by Colonel Fosbery, our Military Departments are now issuing for trial breech-loaders with a smaller bore, and different ammunition

that will, it is expected, shoot better than the present Martini-Henry rifle, instead of paying attention to the other more important question of arming our troops with a magazine rifle. Whether this should be of this kind or that I do not pretend to say; but I think I may safely say this, that it is essential that the British Army, by some means or other, should be so armed that at close quarters they could on occasion fire rapidly eight or ten shots or thereabouts; and I am certain, from what I have heard and observed in this room, that that is the opinion of the practical Officers we have here to-day. I have said we have heard how the Military Departments are rather turning their attention to a new breech-loader than to a magazine rifle. When I saw that Colonel Fosbery was to give a lecture on magazine rifles, I had not the least idea that he would touch upon this new rifle; but I am glad he has done so, because had I been in the House of Commons when the Estimates came on, I intended to have called attention to this very point, and endeavoured to show how desirable it is that we should have a magazine rifle, and that it was more important to have that than to cast the whole thing adrift again by issuing a new rifle with an improved barrel and a different ammunition at a time when there was a hope of soon getting not only the Army, but the Militia and the Reserves, all armed with the same one weapon and one ammunition. Now, it appears the whole question of armament *quâ* breech-loader is to be started *de novo*, and we find ourselves where we were many years ago. I do not think as regards accuracy and range that you want a rifle better than the present Martini-Henry. It is all rubbish about its recoil. I have fired hundreds of shots with it, and it does not recoil; it has been well tested in war by the Turks in the late Turco-Russian War, as well as by ourselves in India and South Africa, and it has stood the test well, although there was a violent set made against it at first by rival gunmakers. I see from the table in my hand taken from the "Volunteer Service Review," that it is the best arm in Europe, and that at 1,200 yards the mean deviation is only 3'80 feet. I have tried it myself, and I said here the other day with reference to long-range shooting, that at 2,000 yards a moderately good shot could put every bullet into Whitehall Yard, and for practical purposes in the field you do not want better shooting than that. But we have heard from Colonel Fosbery that this new rifle is to weigh six ounces more than the other. Well, I hold that to be a great disadvantage. When we wanted small-bore rifles for deer-stalking, thirty years ago, gunmakers at first made them weighing 10 lbs. To carry this weight up hill, and for a long day's stalking, was no joke, and we insisted upon having something lighter, and succeeded in getting efficient rifles, weighing 7½ lbs. Now, when I was a member of the Martini-Henry Committee, I am proud to say I succeeded in getting a pound off the weight of the barrel without increased recoil, and I think it is a considerable mistake to add to the weight of the present Service barrel, and to have a new breech-loading arm when we already have so good a one. Colonel Fosbery has also told us of the sighting of this new arm, which is to have a pendant sight for extreme ranges; but I think any practical man must see that a long pendulum hanging down as shown in the drawing is a most inconvenient attachment to the rifle. No man would use it for sporting purposes; it is so liable to injury and to be put out of gear. Now, on the Army Shooting Committee which was appointed last summer, evidence was given by Major Mackinnon, Adjutant-General of Musketry in India, that they had there made excellent shooting at 2,000 yards by using the ordinary back-sight with the pin of the fore-band as a front sight; and I have myself tested this plan practically with the most satisfactory results. I found that the highest point of the back-sight with the present fore-sight gives you an elevation of 1,400 yards, while by taking the highest point of the back-sight and the pin of the fore-band, I got an elevation of 2,000 yards. I had this pin of the fore-band elongated a little and filed into a cone-shape, and I then added horizontal flaps, working on hinges, to the sliding bar of the back-sight in order to bring this new fore-sight and the back-sight into the same plane. I venture to think that this is a much more simple and practical system of long-range sighting than the pendulum sight already referred to. This, however, is a digression from magazine rifles, but I have only followed Colonel Fosbery's suit. I hope then, as I said before, that we shall not hear anything more of a new breech-loading rifle; but that pressure will

be brought to bear in the House of Commons and everywhere, and on our military authorities, in order that our Army may be speedily armed with magazine rifles.

Colonel FOSBERY: I think I need say but a few words in reply to those who have just spoken. We are all glad to hear from Captain Arthur what wonderful progress has been made in magazine arms in America, and that there exists even a stronger tendency in their favour than we were aware of. With regard to what Admiral Boys has told us of the accident to the Winchester rifle, and Admiral Selwyn's reply in advocacy of that weapon, all I can say is this, that the French authorities quite endorse Admiral Boys' views as to the danger of arranging a string of cartridges, bullet to cap, in a long tube under the barrel, and having been led to adopt a weapon (the Kropatchek) with this arrangement, have introduced into their cartridge an additional safety cap, which will only yield to the blow of the striker of that arm. Further, as to the effects of light bullets in stopping large game, it is true that some will not do so, but then these are light bullets endowed with exceedingly high velocities, as are those of express rifles. The Winchester military arm carries a light bullet, but this bullet has a very low velocity, owing to the small charge of powder used, which is quite a different thing. As to initiating a new series of experiments on cartridges for the use of the Service, I may say that the cartridges issued for experiment with these new arms are the outcome of a vast number of careful experiments conducted with a view of obtaining the best weight and form of projectile, and the best weight of powder to propel it. Such a charge in proportion to the weight of lead as will not produce over-fouling of the weapon in dry weather, and in hot climates. For though it is known that by lightening the bullet, and still further, increasing the charge of powder, most wonderfully good trajectories may be obtained, yet experiment proves that after a certain point you get a degree of fouling out of all proportion to the increase in the powder-charge, a fouling which seems to grow almost in a geometric ratio, and quickly, should the process be continued, renders the arm quite unsuitable for military purposes. I am glad to find that Sir Lumley Graham agreed with what I have said, that ten is about the highest number of rounds that could ever be required to be fired under magazine-gun conditions, and that a weapon containing this number would be sufficient for all our purposes. With regard to the durability of the magazine arm, I am sorry to say, I have seen no reports on the subject, but in several of these weapons the solidity of the parts is so great, that they will bear favourable comparison with the Colt's revolver, or any similar weapon, and what is true of the one would be, within small limits, true of the other. I think any one accustomed to the use of modern firearms will, by inspection, be able to form a very good judgment for himself, as to the durability of any particular specimen.

Finally, Colonel Hope seems to fear we may make some great change in a hurry, and before all that can be done in that direction has been fully considered. I think that everything we want for war purposes can be had in this country, if only we set about it in the right way, *i.e.*, if the Government would make up their minds as to what they really require, and would then say, for example, here is a cartridge and here is a barrel; we require mechanism which will fire that cartridge out of that barrel so many times in a minute. As it is, inventors as a rule do not know exactly what is really wanted, and do not understand the conditions which would favour or debar the acceptance of their plans; if with these indications they were assured that in case of the adoption of part or the whole of their inventions they would be certain of due acknowledgment or reward, I feel sure we should at once have good solutions of this question, and of many others. In foreign countries, as well as with our own countrymen, it has got to be thought, unjustly in many cases, I believe, that inventors do not always get fair treatment, and thus numbers of good men have been deterred from bringing forward plans which would have been of great advantage to the Services. I conclude by thanking Lord Elcho for the kind way in which he has treated what I have said, and I can only hope that the subject on which I have spoken, and which is, I find, considered so extremely important, may now receive such attention as will lead to a solution alike advantageous to the naval and military Services.

Friday, March 31, 1882.

ADMIRAL Sir G. T. PHIPPS HORNBY, K.C.B., President Royal  
Naval College, in the Chair.

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### THE MANŒUVRING POWERS OF SHIPS.

By Captain P. H. COLOMB, R.N.

1. THE manœuvring powers of ships comprise their powers of turning, and of losing and gathering way. The measures of these powers are always twofold: *time* and *space*.

2. In the days of sailing vessels actual measurements of these times and spaces in wearing, tacking, backing and filling, were rarely attempted. The force of the wind was so variable a propulsive power that measurements, had they been carried out, could never have very valuable illustrations; but the measured force of the steam-engine has enabled us to make definite experiments, which are becoming of increasing accuracy and value.

3. The time and space measurements of turning powers are much more numerous than those of losing and gathering way; but we are not masters of the manœuvring powers of any ship until we know both, and the principles which govern them.

4. While in the Mediterranean in command of the "Thunderer," I carried out a somewhat extensive series of experiments for obtaining data of both kinds, and the Board of Admiralty is now preparing to circulate a summary of the principal results for the information of the Navy. I propose to-day to take up the result of a single turning experiment, and to offer an analysis of the principles which appear to me to govern it. I am induced to make this difficult attempt from the fact that there does not exist any complete analysis, and because, though I shall doubtless fall into error on many points of the problem, I shall on the other hand set forth a definite view of the principles which govern the variations in time and space observed in ships turning under different conditions. An exhaustive analysis is impossible in the time at my disposal even were I capable—which I am not—of mastering the higher mathematical reasoning which would then be necessary.

5. Fig. 1 is a trace of the curve described by H.M.S. "Thunderer." The trace is drawn rather differently from what has been usual in the first part of the turn. When the trace is assumed to be that of the centre of gravity—near the middle point of the ship—it has been



FIG. 2.



to move, and when it has changed its direction 4, 8, 12, and 16 points of the compass. I have not time now to describe the method of measurement; but this, with other necessary matter, will be found as an Appendix.

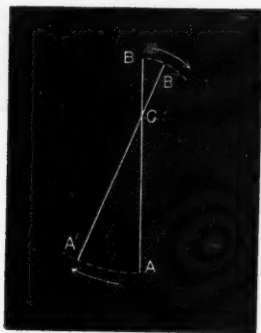
6. To begin our analysis, we must reflect that if we wish to be clear in our conceptions, we must regard the turning of a ship in the water as involving three different kinds of motion.

(1.) The revolution of points in the middle line in opposite directions round a "pivotting point," which point is at rest relatively to the water-plane in which the ship floats.

(2.) Where the pivotting point is fixed in the middle line, but is in motion in the water-plane, while the middle line changes its direction.

(3.) Where the pivotting point is in motion along the middle line, and is also in motion in the water-plane.

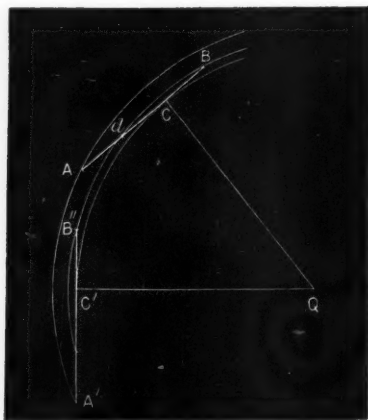
FIG. 3.



7. The peculiarity of the pivoting point is this, that it is always the point in the middle line which has least velocity in the water-plane. In the first case mentioned it has no motion in the water-plane, and we then have turning power in its simplest form. The practical illustrations of this condition are the effect of sails filled at one end of the ship, and aback at the other; the motion caused by the wash of a single screw upon the rudder, before the engines have been sufficiently long in action to produce headway in the ships; the motion produced by a twin-screw, a ship with detached paddle-wheels, or with jet propellers, when the force of one propeller is employed to produce headway, and the other sternway; Fig. 3 is an illustration of this form of motion.

8. Turning, in its next most simple form, is where the motion of the pivoting point is similar—if I may use the expression—to those of all other points in the middle line. A familiar illustration of this motion is given in that of the moon round the earth, if we neglect the motion of the earth in her orbit. The practical illustration is that of a ship turning on her final circle, where the points in the middle line never vary their distance from the centre of the circle, and each describes a circular arc of its own. (Fig. 4.)

Fig. 4.



9. I can further illustrate this motion by a very simple and at the same time remarkable experiment, which gives to my mind a very satisfactory insight into the conditions just described.

I take a common office ruler and suspend it by a line 15 or 18 inches in length, so that it will hang horizontally from my hand. I now give my hand a circular motion in a horizontal plane, taking round with it the point of suspension of the ruler, and leaving the ends free to take any motion imparted by the forces in action. At

first you observe that the ruler gyrates very irregularly, both horizontally and vertically, and it seems very difficult to suppose its motion could ever become regular under the circumstances; but presently the ruler assumes a position tangential to the orbit its point of suspension is describing; new conditions appear to be set up, the tangential position never varies, and the ruler flies round with great speed and violence under a very diminished motion of the hand.

10. Those whom I have consulted do not offer me any distinct explanation of this experiment, but I satisfy my own mind by considering that the point of suspension is the point of least velocity in the system, and that the ruler is in stable equilibrium. The moments of all the forces on one side of the pivoting point being equal to the moments of all the forces on the other side, there is nothing to disturb this equilibrium. If I am told that I am dealing with a dynamical problem,<sup>1</sup> and that the word equilibrium is not admissible, I reply that I see no difference between the ruler thus revolving round the centre of its orbit and the same ruler suspended in a similar manner at the surface of the earth, and so revolving round its centre; except that we are then accustomed to neglect the earth's motion, considering the system at rest, while the difference in the moments of momentum about the pivoting point are too small to be appreciated. I suppose, however, that if we suspended a bar 100 miles long on its centre of gravity at the surface of the earth, it would not remain as a small bar does, in any position in which we placed it, but would ultimately take a position in the plane of its orbit and tangential to it.

11. The most complex motion with which we have to deal is by far the most important in the turning powers of a ship with headway. It is that involved in the first part of her turn from the moment her helm begins to move until she has reached her final circle, in Fig. 1 that part of the curve from P to about  $d^2$ , or the turn of the first eight points. We have not yet a sufficient series of observations between the instant the helm begins to move until the ship has turned four points to plot this curve with accuracy. I am, however, preparing arrangements which, if they are successful, will enable us to do so experimentally. The complexity of this curve consists in the fact that the pivoting point—the point of least velocity—moves along the middle line, while points in the middle line before and abaft it are revolving round it. But it does not appear to me—nor I hope will it appear to you—so very complex as a conception, though the determination of the curve may involve the higher mathematics.

12. Let us revert now to the consideration of turning in its simplest form, as illustrated in Fig. 3, where AB is the middle line of a ship which is turning under the effect of forces acting at right angles to it on an axis at the pivot C, which is at rest in the water-plane.

The two things which oppose a ship's turning in such a way are *inertia* and *water resistance*. They are remarkably different in their

<sup>1</sup> I must apologize for my old-world language. I should have said a 'kinetical' as opposed to 'statical' problem.

effects, inasmuch as inertia as an opposing element is at its maximum when motion begins, and when water resistance is at its minimum. Then as we go on applying the accelerating force of rudder power, or other force which has a moment about the pivoting point, we generate angular momentum and then water resistance up to possibly the square of the angular velocity.<sup>1</sup>

13. If we took a ship at rest in the water-plane, whose middle line was AB, and applied at A a force perpendicular to it acting from A towards A', we should cause motion about an axis passing through some point in the line AB, and the motion would be in opposite directions on opposite sides of the point. Then as the moments of water resistance are, when motion begins, infinitely small, it follows that the pivoting point or, in scientific language, the *instantaneous axis*, about which motion begins, will be determined by the moment of inertia of the ship.

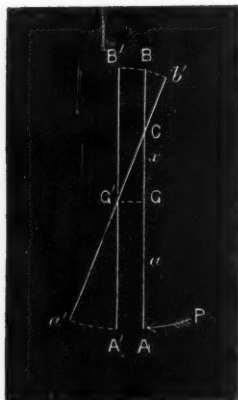
14. For the following beautifully simple and clear statement of the laws determining the position of C, when it is the initial instantaneous axis, or pivoting point, I am entirely indebted to the kindness of Professor Lambert, of the Naval College at Greenwich.

The often repeated, but I suspect not as often understood, principles are :—

(1.) If a number of forces act on a body, the centre of gravity will move as if the whole mass were collected there, and all the forces acted upon it parallel to their actual directions; and

(2.) The rotation round the centre of gravity will be just the same as if the point were fixed.

FIG. 5.



Let AB (Fig. 5) be the middle line of the ship, and let P be the force perpendicular to it applied—as an impulse—at the point A. Then

<sup>1</sup> Mr. White, "Manual of Naval Architecture," p. 599.

the centre of gravity will move to port with a velocity due to the relations between the force  $P$  and the mass of the ship. This results from the first principle.

Then, besides this motion of the centre of gravity itself, there will be a motion of rotation of the line round the moving centre of gravity with an angular velocity due to the relations between the force  $P$  and the moments of inertia about the centre of gravity. This results from the second principle.

The application of the impulse  $P$  will therefore clearly be to move line  $AB$  into the position  $a'b'$ . But then it is equally evident that there has been a point  $C$  which has not been moved at all, and this is then the point through which the instantaneous axis passes, or which is the pivoting point about which motion begins.<sup>1</sup>

15. A suggestion of my late First Lieutenant, Mr. Harington Martin, enables me to illustrate this matter in a very simple way. I take a bar of wood and lay it on a sheet of paper, drawing a line along it to mark its position. Then I push one extremity a short distance by a force at right angles to the bar, and draw another line along it. Then we see that these two lines have crossed at a point near the opposite extremity—at a point corresponding in fact to the point  $C$  in Figs. 3 and 5. But the bar is of uniform section and homogeneous.

<sup>1</sup> I subjoin here Mr. Lambert's exact words, which I at least have never seen surpassed for clearness.

"Let  $AB$  be the middle line of the ship,  $P$  the component of rudder-power perpendicular to  $AB$  (when first put over, of course),  $M$  = mass of ship;  $k$  its radius of gyration. So, then,  $Mk^2$  is the moment of inertia of the ship. Then regarding the force  $P$  as an impulse, the  $C$  of  $G$  will move to port with a velocity  $v$ , determined by  $Mv = P$  or  $v = \frac{P}{M}$  (see 1st principle), and an angular rotation  $w$  will be generated round  $G$ , given by

$$Mk^2w = Pa, \text{ where } a = \text{distance from } P \text{ to } G \text{ (see 2nd principle).}$$

"Now suppose in a short space of time the motion of the  $C$  of  $G$  moves the line  $AB$  to the position of  $A'B'$ , and in the same time the angular velocity turns it into the position  $a'b'$ . Evidently there is a point  $C$  which has not been displaced. The line  $AB$  has really, by the combined effect of the two motions, been transferred to  $ab$ , and  $C$  is the instantaneous centre.

"The position of  $C$  can be determined thus.  $GG'$  and angle  $GCG'$  being described in the same small time, will be respectively proportional to the linear velocity  $v$ , and the angular velocity  $w$ ,

$$\therefore \frac{GG'}{v} = \frac{GCG'}{w} \therefore \frac{GG'}{\angle GCG'} = \frac{v}{w} = \frac{\frac{P}{M}}{\frac{Pa}{Mk^2}} = \frac{k^2}{a}.$$

Note that  $\angle GCG'$  and the angular velocity  $w$  are expressed in circular measure.

$$\therefore GCG' = \frac{\text{arc } GG'}{\text{rad } CG} \therefore \frac{GG'}{\angle GCG'} = CG = x.$$

$$\therefore x = CG = \frac{k^2}{a}.$$

$$\therefore \text{instantaneous centre is at dist. } \frac{k^2}{a} \text{ in front of cent. of gravity.}''$$

Its centre of gravity is therefore in the middle point, and hence we see, both by demonstration and experiment, that the initial motion of a ship's middle line in turning is about a point before—and perhaps well before—the centre of gravity.

16. We must pause for one moment to observe very roughly what conditions would place this point further forward, and what would bring it further aft. If the weights in the ship were moved so as to be concentrated near the centre of gravity, she would have very light ends. The moments of inertia about the centre of gravity would be very small. The movement of  $G$  to  $G'$  (Fig. 5) would evidently not be affected by this, because the mass of the ship would remain the same, no matter how we altered the position of the weights within her. But as the ends are lighter they are more easily caused to move round to point  $G$ , and will therefore move more quickly than before. The result will be that while  $G$  is moving to  $G'$  the angle that  $a'b'$  will have made with  $A'B'$  will be greater than before, or in other words  $C$  will be nearer  $G$  than it was before.

On the other hand, if we moved the weights towards the extremities of the ship, away from the centre of gravity, we should not affect the movement of  $G$  to  $G'$ , but as the ends about  $G$  are heavier, the force  $P$  would give a smaller angular motion to  $AB$  round  $G$  in the same time;  $a'b'$  would be at a less angle with  $A'B'$ , or in other words  $C$  would be further from  $G$ .

17. We can again very neatly illustrate this with the wooden bar as before. I take two equal weights and place them on the bar at its centre as it lies in its old place; then I push the extremity as before, and we see when the second line is drawn that it crosses nearer the middle point than before. I now repeat the former process, but place the weight at the extremities, the result is that the lines cross further from the middle point.

18. Now, remembering how the first motion of the ship is determined entirely by the disposition of her weights, and chiefly in a fore and aft direction, we seem able to say, without much fear of being wrong, that a *ship with light ends will answer her helm early*, and that she will at first pivot on a point *before the centre of gravity, but near it*. Next, that a *ship with heavy ends will answer her helm late*, and she will at first pivot on a point *before the centre of gravity, but far from it*.

19. But now, when we have once started the ship, so that every point in the middle line begins to revolve round this pivoting point, we get momentum of all the particles in the ship round this point. There are in fact moments of momentum set up by the first action of the rudder, which are added to the moment of rudder power, and increase as the angular velocity increases. But a check to this growing angular velocity is developed by the increasing resistance of the water. Then we have, tending to turn the ship round on the pivoting point, moments of momentum and moment of rudder power, which are opposed by moments of water resistance. It is evident that ultimately, moments of momentum must be equal to moments of water resistance, and that there will remain the constant force of the

moment of rudder power opposed by equal moments of water resistance, leaving no unbalanced force, and so giving a uniform angular velocity to the middle line.

20. If the centre of lateral resistance—the centre of gravity of the submerged plane passing through the middle line—were in the same vertical line with the centre of gravity, and remained there, the development of water resistance would not, it is to be presumed, affect the problem. But if this centre of lateral resistance were before the centre of gravity, its position would tend to move the pivoting point forward. If the centre of lateral resistance were abaft the centre of gravity, the tendency of its position would be to move the pivoting point aft.

21. It must always be borne in mind that the pivoting point—or the point of least velocity—is always perfectly neutral. There is no pressure on it on either side of the line, and the moment pressure on either side is brought to bear on it by changes in the moments about it, it will move to some position where it is again neutral.

22. But water resistance depends not merely on the area of the submerged plane, nor does the centre of resistance correspond to the centre of gravity of the plane. Both the force of resistance to a body in motion in water, and the position of its centre of effort, depend upon the facilities offered for the escape of the streams impinging on it. It requires a greater force to drive the submerged portion of a ship at a given velocity, than it would take to drive her were the same portion several feet below the surface. For in a ship, while the water can escape under the bottom and round the bows, it cannot escape over the top of the submerged section, and must pass off instead in waves on each side. The rounded form of a ship's broadside under water offers different degrees of facility for the escape of the water, and the amount of obliquity to the direction of its motion will both affect the position of the centre of resistance, and it is to be supposed also, that difference of angular velocity in turning may again change it. Not to go more deeply into a question which would carry us away too far, we may rest here in pointing out that the development of water resistance may move the pivoting point about, possibly from aft forward, possibly from forward aft, until the complete balance between moments of momentum and moments of water resistance about the pivoting point are established.

23. The difficult point which arises for discussion here, is as to the moment of rudder power. This moment must increase as the pivoting point moves forward—for the moment is about this point. But if it so increases, must we not get a corresponding increase in the angular velocity? in other words, a quicker turning ship? It seems to me very important to know what we are going to aim at. Do we want the ship to pivot at her stem, or at her middle point, or at some point between the two, so as to get the best result out of the rudder? Let me here remark that it is conceivable in the case we have just been discussing, that water pressure may have a certain spring in it, which may temporarily yield to momentum, and then recovering itself, cause a check to momentum by checking velocity.

Is it not possible that the maximum angular velocity may not be the final uniform velocity, but that the latter may be something less than the maximum?

There are, in fact, experimental data for believing this to be the case.

24. We must now pass to consider the next more complex set of conditions under which a ship turns, those, namely, when she reaches her final circle, and when every point in her middle line describes a circular arc round the centre of the final circle, as shown in Fig. 4.

25. I must say frankly at the outset, that it seems as if the conditions of this problem have been very generally misunderstood. Probably no one has written more carefully or thoughtfully on this matter than Mr. White in his "Manual," yet he at first considered a ship as rotating on her centre of gravity, and says that "the motion of rotation constantly makes the bow of the ship turn inwards from the tangent to the circular path, along which her centre of gravity is supposed to travel; and as a consequence there will be an accumulation of pressure on the outer (or lee) bow."<sup>1</sup> But without any doubt the pressure of water is on the inner, and not on the outer bow. A bow rudder pivotted on its fore end and free to move, will always make an angle outwards, and not inwards, when a ship is turning on her final circle—as I have ascertained by actual experiment—and moreover, if you will stand at the stem of a ship, and lean outwards facing aft so that you can see the water-line on both bows, you can observe quite distinctly the break against the inner bow, and the smooth left by the outer bow, just as you have it in a much greater degree, the broken water on the outer quarter, and the smooth on the inner.

26. There is no question about "rotation" here, round any point in the middle line. In a motion of rotation it is essential that the point of least velocity shall describe a path which is *dissimilar*—it is a different curve—from that of every other point in the line. But here all points in the line are describing similar parallel curves—circular arcs. There is no rotation, and moreover no force to cause rotation, for the sum of the moments of all the forces on one side of the point of least velocity are balanced by the sum of all the moments on the other side. The conditions appear to be precisely those of a bar suspended on its centre of gravity at the surface of the earth, or of the ruler we saw in motion in my hand. The forces acting from and towards the centre of motion on one side of the pivot are balanced by the forces acting from and towards the centre of motion on the other side of the pivot. There is simply no force existing to alter these conditions, which are consequently permanent. That is to say, *the system is in equilibrium*. The path pursued must be circular, for any other would alter the conditions at each instant, whereas the basis of the whole problem is that the conditions do not alter.

Let us note, as we can easily do, the forces in action about the pivoting point C. We must understand that the middle line AB has passed from the position A'B', and every point in the line is describing a circular arc round the centre Q.

<sup>1</sup> This proposition Mr. White proposes to alter in his second edition.

27. The particle at the point C, as that which has least velocity, we may assume to have least momentum, and then the forces of momentum about that point are the differences between that of the particle there, and that of all the other particles in the middle line. Moreover, the momentum of the particle at the point C is acting always along the line AB. If we could suddenly arrest the point C we should at once get a true rotation about it, as, though we should have arrested the force of momentum along the line AB, we should leave the components of this force perpendicular to the line, in action.

28. Thus, if we omit the consideration of the momentum along the middle line, we may consider the forces about the point C as if it were at rest. Then on the B side of C we have a moment of momentum *in favour* of the rudder power, which may be considered as a force acting perpendicularly at the centre of gyration of the part CB. This is met by a moment of water pressure which is against the rudder, and may be said to be a force acting perpendicularly at the centre of lateral resistance of the part CB, such centre being, of course, determined by the angles the stream lines make on the body of the ship, and the opportunities its form offers for the easy or difficult escape of the streams. At C there is no lateral water pressure due to velocity, neither on one side nor on the other. It is, so far as such pressure goes, a perfectly neutral point; just as, so far as moments of momentum go, it is also neutral.

29. But now, passing from C to A, we find momentum on this side of C, also in favour of rudder power, becoming a moment as acting at the centre of gyration of the part CA. Then we have the water pressure on the outside from C to A acting against the momentum, and consequently against the rudder power. It becomes a moment when its component is considered to act perpendicularly at the centre of lateral resistance of the part CA, which is subject to the same determinations as that of the part CB.

30. Lastly, we have the moment of rudder power at A, that is, the turning component of the pressure on the rudder into the length of the arm AC.

31. So that we have on the B side of C a moment  $= \frac{m}{R}$ , if  $m$  = moment of momentum of the part CB, and  $R$  = moment of water resistance of the same part. On the A side of C we have  $\frac{m'p}{R}$ , if  $p$  = the moment of the turning component of rudder pressure. And then we have  $\frac{m}{R} = \frac{m'p}{R}$ , and the point C takes a circular path because any other would destroy this equality.

32. These conditions are, perhaps, obvious when they are pointed out and illustrated by the simple ruler experiment. The velocity of the point B is greater than that of C or any point between the two, and is equal to that of the point *d*. The velocity of the point A is greater than that of any other point in the line, and the velocity of each point diminishes from A to C until at C we get the point of least

velocity in the whole line. Then, supposing we were dealing with a homogeneous body of equal section, the particle at A would have the greatest momentum; the particles at B and *d* would have equal and opposite momenta, and the momenta would diminish uniformly with the distances from C, until at C they would be at zero. Then if the action of the water streams were uniform throughout, we should have the moment of pressure on CB equal to those on Cd, and opposite to it, and each opposed to the corresponding moment of momentum. In this case we should find the moments of rudder power, and of the momentum of the part Ad, balancing the moment of water pressure opposed to them in the same part.

33. A familiar confirmation of this way of looking at the problem will probably occur to many of my audience. Every one who has had a helm in his hand knows how the strain on it diminishes after it has been over for a little time. It is, in fact, employed in the first instance in a vessel with headway in altering the relative direction of the momentum of the particles in the vessel until this direction becomes permanent, as on the final circle. When this is reached, the helm has no more to do but to supply the moment of momentum of the part Ad, to make it balance the moment of water pressure on the same part.

34. If we supposed the centrifugal force from C to B equal to that from C to *d*, we should clearly have no water pressure to prevent the ship flying outwards from the centre Q, because there is as much pressure on one side pressing outwards as there is on the other pressing inwards. In this view it must be the action of the part Ad which determines the radius of the circle, as there is no water pressure on the inside to balance that on the outside, which is therefore determined by momentum and rudder power alone.

35. The determination of this final pivoting point C, I will frankly own is beyond me at present. I can only faintly suggest some considerations which cause its removal aft or forward, and some of the results which might attend such removal.

36. But it might just be well to repeat the ruler experiment and its conditions in order to see how complete the analogy with a ship on her final circle is. The neutral point in the ruler is the centre of gravity at which the string is attached. The force of gravity is substituted for water pressure, and its action is not, as in the line AB in the figure, on the part Ad, counteracting centrifugal force, but at the centre of gravity of the ruler. When I develop momentum by a more rapid motion of my hand, I get such an increase of centrifugal force as raises, against the force of gravity, the plane of the orbit which the centre of my ruler describes. Then I get the equal increases of my moments of momentum about this centre, keeping the whole system in equilibrium.

37. There is in a ship, no corresponding force to cause motion, such as my hand supplies. An increase of propulsion, equally with an increase of helm-angle, tends to disturb the equality of the moments about the point C, and the question is open whether the increase of moments of water pressure would tend to restore the equality of those disturbed moments. If the ratios between the

moments about C remained unaltered, we should get C describing a circle with a greater radius. If the ratios of the moments were disturbed, the point C would shift.

38. If we added to the moment of momentum of the part CA—say by shifting weights aft—the point C would shift towards B, unless by the change in the trim the increase in moment of momentum were balanced by an increase in moment of water pressure. If we increased the moment of momentum of the part CB, we should also move the point C forward, unless a counterbalancing increase in the moment of water pressure were established. If we moved weights towards C from the A and B ends, so as to reduce the moments of momentum equally, without altering the trim, it would appear that we should move C aft, as we should be reducing the moments of momentum about C in favour of the rudder power, while we left the moments of water pressure against it untouched.

39. If we add to the moment of water pressure of the part AC, it appears that we should produce results similar to those above described. We should offer a greater resistance to the action of the momentum and of rudder power combined. C would move aft, seeking to re-establish the balance of moments. The moment of rudder power would then be directly affected, and C would move still further aft till the balance was restored. Adding to the pressure of water on the B side, would produce similar results, but then the arm CB being shorter than the arm CA, it would take a proportionately larger surface to give an equal moment of pressure.

40. If we cut away the deadwood at the after end A, we shall reduce the moment of water pressure. Thereupon the moment in favour of rudder power will be increased, and C will move forward to re-establish the balance. The moment of rudder power will thus be directly increased, and the point C will move still further forward till the balance is restored. If we cut away the forefoot at B, we should produce similar results to the foregoing, but less in degree in proportion as the arm CB was shorter than the arm CA.

41. Lastly, if we were to increase the moments of momentum by moving weights from C, towards A and B, without altering trim, we should shift the point C forward if the moments were increased in equal ratio. For we should increase the moments in favour of rudder power, without increasing the moments of water pressure against it.

42. Thus far, as to the causes which seem to affect the position of the pivoting point C on the final circle by moving it forward or aft. If my theories are true in principle, we get a nice explanation of why a ship with a pivoting point far forward should turn on a smaller final circle than one whose pivoting point is nearer the centre of the ship. I have said that pressure on the outside of the part Ad, having no water pressure on the inside to balance it, must be the measure and balance of the centrifugal force. Anything which increases this pressure must decrease the radius of the arc which any point in the part is describing; anything which reduces the pressure must allow the radius to increase. But all movements of the pivoting point *forward* tend to *increase* the length of Ad, and by

consequence the surface exposed to pressure from the outside; while all movements of *C aft* tend to *decrease* the length of *Ad*, and the surface exposed to pressure on the outside. Then in the former case there is greater opposition to the centrifugal force than in the latter, and we get the smaller circle.

43. But the *time* as well as the *space* occupied in turning is affected: upon which the following remarks may be offered. If the velocity over the arc is not affected, we find that the time in turning through a given arc will vary directly with the radius, and so far every movement of *C aft* would be a corresponding loss in time and space. But if the reduction of the radius is obtained by an increase in the total water pressure due to a given velocity, then the velocity over the arc with the smaller radius may be reduced to an extent which will eliminate the expected gain in time. On the other hand, if in moving *C aft*, we so reduce the surface exposed to pressure due to velocity, we may gain in time what we lose in space.

44. Now in all movement of weights without altering trim, we clearly increase the total of water pressure on *Ad* when we move the point *C* forward, and reduce it when we move the point *C aft*. In the one case the ship lies more across the path she is travelling over than in the other—or as we now express it—the *drift-angle* is greater in the one case than in the other. We may not in such a case gain in time, all that we gain in space. But if we move the pivoting point *C* forward, by cutting away the deadwood abaft, we may expose no more surface to pressure than before, and may gain the full amount of time due to the gain in space.

45. Whether it is worth while to cut away the forefoot, will depend upon the position of *C* beforehand. If *C* is already far forward, the arm *CB* will be so short that we cannot expect to produce much result. But cutting away the deadwood abaft is certain, apparently, to give us a small final circle, with little or no loss of time in turning over it.

46. Moving weights aft, so as to increase the after moment of momentum about *C*, will affect the trim and bring the ship down by the stern. The one operation tends to move *C* forward, the other to move it aft. The result upon the space and time will depend upon which moment has the greater increase. If we remove weights from the fore end of the ship, so as to lighten it by the head without altering the draught by the stern, we shall move the pivoting point aft. There will be a loss of water pressure due to the less quantity of submerged surface and to the reduction of *Ad*. The final circle will be larger, but as the velocity will be increased, the time of turning through a given arc will not be increased in like ratio.

47. Whatever may be the truth of these speculations—which, so far as I know, are almost entirely new—there are practical experiments to bear out the truth of some of the results. Mr. White, of Cowes, in cutting away the deadwood of his torpedo-boats produced all the results I should have expected. When I placed at the forefoot of a steam pinnace a small piece of false keel, I produced on her time and space in turning an insignificant effect. It was rather in favour of the rudder power, but the measurement of time and space included move-

ment before she reached the final circle. When, however, I moved the same piece of false keel to a position under the stern-post, I just *doubled the time and space required to turn in.*<sup>1</sup> As the "Thunderer" lightened by the head only, when her coal supply began to run short, her whole space in turning, as well as the radius of her final circle, were increased, but the time was not increased in the same proportion.

48. If there be, then, a substratum of truth in these demonstrations, supported as they are in instances by experiment, we ought to be able to speak of bow rudders with some approach to definition. Their general failure, if not due to conditions prior to the arrival of the ship on her final circle, may perhaps be set down to the relative shortness of the arm at the end of which they act, when the ship is on her final circle. But this failure would not be marked where C was well aft, while it might be absolute in a ship whose pivoting point was so far forward as to be over the rudder. But, in any case, the tendency of the bow rudder is to move the pivoting point *forward*, and therefore to reduce its own moment. We have seen that any increase of the moment of momentum of the part CB tended to move C forward, and was a force in favour of the after rudder power. The movement of C forward necessarily increased the moment of momentum of the part CA, and the result was an arc of less radius, with a gain in time less in proportion. A bow rudder between C and B (Fig. 4) put hard a-starboard—the opposite way to the after helm—would be an increase of moment of the part CB in favour of after rudder power; but then it adds to the water resistance by itself, as well as such increase as may arise from the movement of C forward. There can, then, be no increase of momentum, and therefore no increase of moments of momentum. Then as C moves towards the bow rudder, the moment of its turning component diminishes; so that in the result, we could hardly expect any marked effect. Speaking generally, it is perhaps not incorrect to say that a bow rudder has exactly the contrary effect of a stern rudder. With a stern rudder, the greater its turning component the greater will be its moment on the final circle. With a bow rudder, the greater its turning component, the *less* may be its moment; as C, the pivoting point, moves forwards *from* the stern rudder and *towards* the bow rudder in both cases.

49. We have now sufficiently discussed the conditions of a ship on her final circle where the point C, the pivoting point, or the point of least velocity, is fixed in the middle line. We now reach the most difficult problem of all, namely, the consideration of that part of the turn from the time the helm begins to move until the ship reaches her final circle.

50. We have already seen that in a ship without headway the less the moments of inertia about the centre of gravity are—that is, the

<sup>1</sup> The area of the piece of false keel was 6 sq. ft. = '053 of area of mid-line plane. The C of G of the false keel was 4 ft. 7½ in. before the rudder post when aft, and 30 ft. 6 in. before it when forward. The centre of lateral resistance was 18·2 ft. before the rudder post originally. The false keel aft moved in '68 ft. aft; the false keel forward moved in '61 ft. forward.

lighter the ends are—the *earlier* will she answer her helm, and the nearer will the pivoting point be to the centre of gravity. We have seen further, however, that if the final pivoting point is near the centre of gravity, this point being itself near the centre of the middle line, the radius of the final circle will be large.

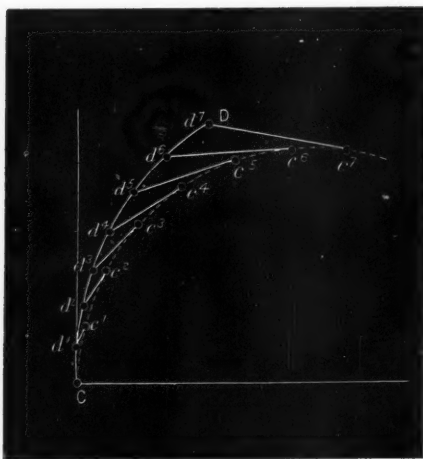
51. If the pivoting point taken up at the first movement of the helm did not move, the ship would start on her final circle, of which the centre would be abeam of this initial pivoting point.

52. If the pivoting point moves, it must move from its initial position forward, or aft, to its final position, and it is conceivable that it may have these opposite motions in succession before it takes up its final position.

53. It seems as if it could be stated that whatever movements of the pivoting point do take place before it becomes fixed, on the final circle, its last movement is *from forward aft*, and not *from aft forward*. This results from the natures of the curves described by any fixed point in a line, when a movable point before the fixed point describes any given curve, and continually increases or decreases its distance from the fixed point. The curve described by the fixed point is somewhat of the nature of an involute, and it constantly approaches the evolute from which it is derived, when the distance between the fixed and movable points decreases; as it constantly recedes from the evolute when this distance increases.

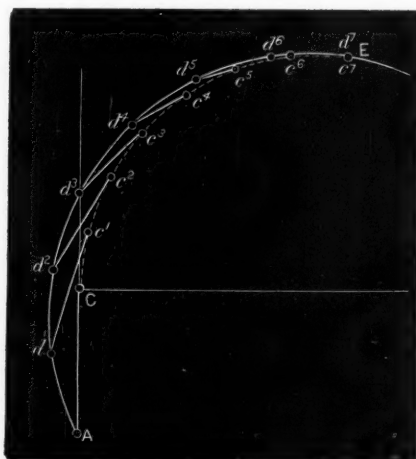
54. The evolute with which we have to deal is the final circle, and Figs. 6 and 7 show us the curve receding from, and merging into, the final circle. In Fig. 6, C is the pivot at starting and coincides with the position of the fixed point closed. Then  $c^1, c^2, c^3, \dots c^6$  are the

FIG. 6.



positions of the moving pivotting point, travelling over the circumference of a circle at a uniform velocity, and at the same time moving *forward* along the line—increasing its distance from the fixed point—also at a uniform velocity, though at a less one than that over the arc. The resulting curve described by the fixed point, is the curve CD, of which  $d^1, d^2, d^3, \dots d^7$  are the determining points, and correspond to the positions which would be taken up in successive intervals of time by the fixed point in the line from which the pivotting point C originally started. But this curve will never approach the curve described by the pivotting point; it will continue till  $dc$  becomes infinitely long. But such are not the conditions we ascertain by experiment to exist in a ship turning.

FIG. 7.



55. Fig. 7 gives us the curve described by the fixed point A in the line, when the movable point C is at its greatest distance from A, and describes the arc of a circle CE at a uniform velocity, while at the same time it moves along the line towards A, at a lesser uniform velocity.  $c^1, c^2, c^3, \dots c^7$  are the positions occupied in successive intervals of time by the moving pivotting point, while  $d^1, d^2, d^3, \dots d^7$  are the corresponding positions of the fixed point in the line until at  $c^7$  fixed and moving points coincide. The close resemblance of this curve to that in Fig. 1 is noticeable. The last part of the curve as it approaches the circular arc is, at least, a very close approximation to the result of experiment.

56. The curve given in Fig. 1 is described by a ship with large moments of inertia, and therefore we must assume that the initial pivot is far forward; but looking at the form of the bow, and of what

we know as to the position of centre of pressure in planes moving obliquely in water, it is not impossible that the first action of the developed moments of water resistance may be to move the point still further forward. We should easily get in this way the early curve in Fig. 7. But then, as the moments of momentum increase, we should get water pressure on the starboard or inner bow, of which the result must be the movement of the pivoting point aft, until it fixes itself on the final circle.

57. The curves in Figs. 6 and 7 are drawn, as I have said, by allowing uniform velocity in the movement of the pivoting point along the line. But there is every reason to believe that this motion is not uniform. In an experiment made for the purpose, I found the changes of direction in the middle line of  $20^\circ$  each occupied 37 seconds for the first, 18 for the second, 16 for the third, 15 for the fourth, 16 for the fifth and sixth, 18 for the seventh, and 19 for the eighth. We have quite clearly a minimum rapidity of change, increasing to a maximum, and then diminishing to a final rapidity. It is quite possible that the movement of the pivoting point along the line may follow this law. It may be placed well forward when change of direction begins; it may move very slowly forward for an interval, then more rapidly aft again, reaching a maximum rate which diminishes again as the first approaches its final position, and motion along the line ceases.

58. Whatever truth there may be in these hypotheses, they have this advantage, that they agree with the existing data, and when once we form an hypothesis we are—even if it is a false one—in a better position than we were before we possessed any.

59. In concluding this analysis, we are brought face to face again with the questions I propounded in my 23rd paragraph, but extended. In seeking a “handy” ship, what do we strive for? Do we want the ship to pivot finally at her stem, at her middle point, or at some point between the two? Do we seek to fix the pivoting point in its final place in the middle line, early or late? Do we want it to move from an after position to a forward one, or from a forward one to an after one? It is in the proper answers to such questions, and in the application of right principles to practice, that we shall get really handy ships.

60. If the principles I have been endeavouring to sketch out are in the main true, there are two things very fairly under our control which will make a ship *unhandy*, so far as the single turn is concerned. These are concentration of weight about the centre of gravity, and draught of water by the stern. The result of the first will be to place the initial pivoting point far aft. The effect of the second, and of both combined, will be to keep it there. You will get your helm answered *early* in a ship with light ends on an even keel and the ship will unquestionably be called a handy ship so long as she never faces anything beyond the wants of ordinary navigation, has never to manœuvre with a fleet, or to attempt to avoid collision. But tried in these latter ways she will lose her character. She answers her helm readily, because the moment of inertia is small, but just for that reason her

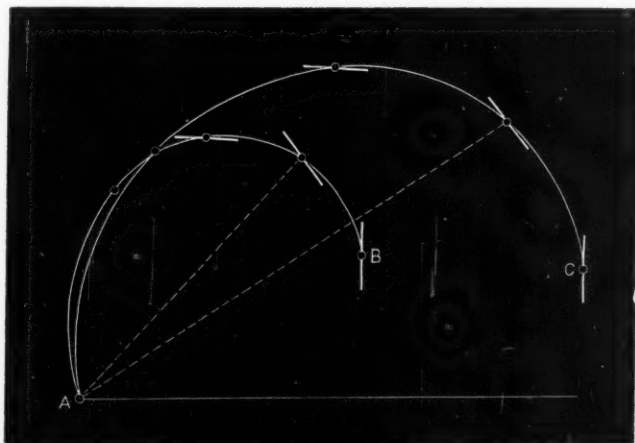
moments of momentum are also small, and are soon balanced by the moments of water pressure. The path her middle point describes will be nearly circular from the moment the helm begins to move, but the radius of the circle will be large; turns of 4, 8, 12, and 16 points will occupy much space and long time.

61. If we add to this ship an excess of draught by the stern, we shall but still more check her powers of turning. The pivoting point will move aft more rapidly from its initial to its final position. The moment of water pressure against the rudder will be increased. The ship will arrive still earlier on her final circle, and the radius of such circle will be still larger.

62. Recent experiments of my own have pretty well demonstrated the effect of draught by the stern, but I believe it to be still almost universally held that a ship with heavy ends is necessarily an unhandy ship. I believe her to be a slow ship in answering her helm, but handy for most of the purposes of war.

63. We are in a condition to contrast the turning powers of two ships—the “Thunderer” and the “Iris”—in which these hypotheses are curiously confirmed, unless there are other conditions unknown to me to account for the differences. The “Thunderer” is a ship with necessarily large moment of inertia—heavy ends; the “Iris” a ship with remarkably light ends, and, therefore, small moment of inertia. Fig. 8 gives the traces of the curves described by the central point of

FIG. 8.



the ships under nearly the same conditions, and measured in the same way, namely, in the way I found so successful in the “Thunderer.” The difference of turning power in favour of the “Thunderer”—

the curve AB—is so very marked that it is in no way to be accounted for by the  $2^\circ$  greater helm-angle of that ship. The speed of helm movement in both ships appears to have been the same.<sup>1</sup>

64. Taking the turn of 12 points as the measure of the turning power, we have the "Thunderer" with a chord of 5.03 lengths, in 6.4 time-lengths; against "Iris" with a chord of 7.3 lengths in 9.1 time-lengths. The "Thunderer" was 1 foot 6 inches, and the "Iris" was 3 feet, by the stern. The speed of the "Thunderer" was 7.9 knots, and of the "Iris" 8.6 knots. The "Iris" with  $32^\circ$  of helm is about equal to the "Thunderer" with  $24^\circ$  of helm, as in the latter case the chord of 12 points is 7.10 lengths in 7.8 time-lengths. There is a possibility that difference of mean draught or, in other words, difference of area of immersed middle line plane—what I propose to call the *coefficient of absolute resistance*—may, in some sort, account for the difference, as the "Thunderer" had a mean draught of 26 feet 7 inches, and the "Iris" only 18 feet. But if my hypothesis be correct, this mean draught perhaps is beside the question.

65. This concludes what I propose to say on this question to-day. There remain yet an infinite variety of heads of inquiry which I have not even attempted to glance at.

#### APPENDIX.

##### *Method of Measuring Turning Powers.*

Choose a calm still day in the open sea, but in view of a distant point of land or object sufficiently conspicuous for observation. If Sir William Thomson's compass is on board, and corrected accurately, it may be used instead of a point of land, and is in some respects more convenient.

Prepare two casks similar to the usual targets, each with a different coloured flag upon a staff. Care must be taken to weight the casks, so that a very few inches remain above water: this is in order to prevent wind-drift, an element calculated to mar the accuracy of the experiment. The gun-directors are to be placed on the side of the ship towards which the turn is to be made. If she is to turn to star-board, the gun-directors are to be placed on that side, as far apart as possible, and at equal distances from the middle line of the ship. The zero point of the directors should be exactly abeam, and the distance between the zero points forms the base of the triangles.

A dumb compass should be prepared—an azimuth instrument without the compass card answers very well—and fixed in a convenient

<sup>1</sup> The area of "Iris" rudder is 138 sq. ft. That of the "Thunderer" is 174 sq. ft. Area of "Iris" mid-line plane is at 18 ft. draught, roughly, 5,400 sq. ft. Area of "Thunderer's" mid-line plane at 26.5 ft. mean draught = 7,552 sq. ft. So that "Iris" rudder is .0255 of mid-line plane, while "Thunderer's" is .0230, or rather smaller.

position for observing the distant point of land. If Sir William Thomson's compass is used the dumb compass is not required.

Four observers are necessary: one to note the successive bearings of the distant point, or change of direction of the ship's head every four points, one to note the times, and one at each gun-director to note the angles between the perpendicular to the middle line of the ship and the bearing of one of the buoys.

All being in readiness, the two buoys are to be dropped about 1,500 yards apart, on a bearing convenient for observing the distant object at each point in the turn round either of them. Hands are placed by the engine-room telegraphs, one to sound a gong to the engine-room, and one at the siren or steam-whistle. The engineers are directed to note the engine-counter at each sound of the gong; the man at the siren is directed to sound it at the words "Stand by" and "Stop," the gong to the engine-room being sounded at the word "Stop."

The ship is now put on a course nearly parallel to the line of the buoys and at the speed desired (see Fig. 9). One buoy is passed in this

FIG. 9.



manner, but when the second comes about 4 points on the bow, the observer noting the time gives the words "Stand by" and "Stop." The siren sounds for each, and at the second the helm is moved to the determined angle, the observer at the compass notes the position of the ship's head, the observers at the gun-directors note the bearings of the buoy, and the engineers note the engine-counter.

As the ship arrives at 4, 8, 12, and 16 points change of course, the observer at the compass in like manner gives the words "Stand by" and "Stop;" when the siren sounds, and the time, angles, and revolutions are taken.

When a series of observations completing the turn of 16 points is thus taken, the ship proceeds on a course nearly parallel to the line of the buoys, and a turn of 16 points is made round the other buoy, either at the same speed and helm-angle, or with any desired variations of either or both. The experiments may, of course, be varied by stopping or reversing one or both engines in a twin-screw, at any point in the turn; and in all cases the exact position of the ship when she has turned 4, 8, 12, and 16 points respectively, can be laid down from the observations.

The method works exceedingly well and speedily, and is remark-

ably accurate. In an afternoon of three hours in all I have laid out the buoys, and made as many as fifteen distinct experiments.

The plan will be understood from Fig. 1, which represents an actual complete experiment. Here the ship has arrived on a straight course at the point P, then going 5 to  $5\frac{1}{2}$  knots with 35 revolutions. At this moment the helm is ordered  $34^\circ$  a-port, the angles  $abh$  and  $bah$  are observed, the engine-counter noted, and the time taken. At  $d^1$  the ship has turned according to dumb compass and distant object exactly 4 points, at  $d^2$  8 points, and so on; and at each position the observations are repeated, the experiment being complete when the centre of the ship is at  $d^4$ . The respective positions can be readily laid down to scale by a protractor with sufficient accuracy for practical purposes. The method of using two buoys is illustrated on a smaller scale in Fig. 9; the object in using two being the saving of time, and the certainty of allowing the ship to recover herself before an experiment is repeated.

#### DEFINITIONS.—(FIG. 1.)

*Octant*.—A turn of 4 points, as  $Pd^1$ ,  $d^1$ ,  $d^2$ , &c.

*Final Circle*.—The path a ship ultimately takes, assumed to be the circumference of a circle through the points reached at the end of the 2nd, 3rd, and 4th octants, as the arc  $d^2$ ,  $d^3$ ,  $d^4$ , of which (C) is the centre.

*Final Diameter and Radius*.—The diameter and radius of the final circle.

*Advance*.—The distance travelled over at any point of the turn measured in a line parallel to the original course. Thus  $f^1d^1$  (Fig. 1), is the advance at 4 points;  $f^2d^2$  is the advance at 8 points, and so on.

*Transfer*.—The distance travelled over at any point of the turn to the right or left of the prolongation of the original course, measured in a line at right angles to it. Thus  $e^3d^3$ , is the transfer at 12 points; and  $e^4d^4$  is the transfer at 16 points.

*Note*.—The advance is thus the ordinate, and the transfer the abscissa of the curve at any point.

*Tactical Diameter* is the transfer at 16 points; as  $e^4d^4$ .

*Drift-angle*.—As the angle, at any point of the turn, between the normal to the curve the centre of the middle line is at that moment describing, and the normal to the middle line. Thus  $g^1$ ,  $g^2$ ,  $g^3$ , and  $g^4$ , are the drift-angles at 4, 8, 12, and 16 points.

*Chord* of so many points is the distance between the centre of the middle line at the moment of moving the helm, and its position when so many points have been turned. Thus  $Pd^3$  is the chord of 12 points. It is a convenient measure of turning powers so far as space is concerned.

*Length* is the length of a ship between perpendiculars. It is used to compare the space measures of different ships' turning powers. Thus, the advance is so many lengths; the transfer so many; the chord so many, and so on. When one ship shows a greater number of lengths than another, in any of these magnitudes, she has so much worse turning powers than another, so far as space is concerned.

*Time-length* is the time it takes a ship to pass over her own length. It necessarily varies with the speed, but is a useful time-measure for comparing the turning powers of any two ships. Thus a ship is said to turn 4, 8, or 12, or 16 points in so many *time-lengths*, and if another ship is shown to take more *time-lengths* to make the same turn, she has worse manœuvring power than the other, so far as *time* is concerned.

The following are some of the terms I have used to separate and compare the elements which probably influence turning powers.

*Coefficient of Rudder Power*.—The area of the rudder divided by that of the middle-line plane.

*Coefficient of Absolute Resistance*.—The mean draught divided by the length.

*Coefficient of Relative Resistance* is excess of draught by the stern over that by the head in inches, divided by the length in feet.

*Coefficient of Tiller Power*.—The speed of helm movement got by dividing the time occupied in putting the helm over to its ultimate angle, by the *time-length*, and then dividing the number of degrees in the ultimate angle by the quotient.

Vice-Admiral Boys: I feel great diffidence in rising to commence the discussion of this very important and interesting paper; in fact, I may say at once that I do not feel myself competent to criticize it. But still I think it is a duty that we older Officers should give our experiences in discussions of this kind, especially in such a matter as the manœuvring of ships of war. There are one or two observations I should like to make with regard to Captain Colomb's statements. And first as regards his pivoting point C; does he consider it a fixed point on the water plane? Perhaps he does not. I cannot help thinking he has not made it sufficiently clear, because I consider that a most important condition in the manœuvring and turning power of ships. I think their actual manœuvring powers are mainly dependent upon their draught of water and length in comparison to their bulk. As illustrations of what I mean I will give the following cases; to begin with the paddle-box boat: no doubt several Officers present have served in paddle steamers and used paddle-box boats: they are very useful as carrying boats, and I have landed as many as 150 slaves from one of them at Sierra Leone; but they are the greatest brutes possible to handle either in pulling or towing. In going up narrow rivers with them it is difficult to keep them clear of the banks. Their bows will turn as you please, but still they have no manœuvring power. We then come to gunboats of the "Comet" class, a useful class, but of very light draught and very short. I was once taking the "Comet" herself out of Portsmouth harbour. We had to pass a drifting barge which had a square bow; the helm was put over in time to avoid the barge; but instead of clearing her the gunboat continued the motion she had before she began to obey her helm at all; the consequence was one bow of the barge went clean through the gunboat's side before we knew where we were. Of course we took care afterwards to give every thing a wide berth. Then we have gunboats of the "Medina" class; very short, very broad, with very light draught of water. They answer the helm very quickly, sometimes too quickly. In fact they sheer about so that you cannot say they have any manœuvring power at all. Then we come to the "Glatton" class, where the same description of form answers to a certain extent. I have had considerable experience in the "Glatton" as a tender to the "Excellent," and can give an instance in which the side motion of the pivoting point, although unintentionally given, did good service. It was my duty to carry out a series of experiments some years ago with the Harvey torpedo. A tug boat was towing the torpedo, and we in the "Glatton" were to avoid it in the best way we could. On several occasions we avoided it simply by the side motion of the ship, given by the

action of the helm. The torpedo just passed along our side; but from our lee-way, if I may so call it, we escaped it altogether. In a turret squadron, of which I had charge for some time, all short, light draught ships, it was most difficult to get the ships to follow one another in line, especially at first, before Officers and men had experience in handling and steering them. Occasionally they would not go straight, one sheered to the right, and another took sheer to the left. I think that is a question bearing on manœuvring power. Then I mention another class of construction of light draught, namely, the Bermuda Dock. It was my duty to tow that dock across the Atlantic. Captain May brought her as far as Madeira, and I took her from him. The dimensions of the dock were, approximately, 380 feet long, and 140 feet broad; her draught of water 13 to 15 feet. At first the hawsers were made fast to the extremes of the two bows, the idea being that she would sheer tremendously. After a little experience, Captain May had them fixed to the centre of the bottom of the dock. We found instead of taking broad sheers she simply slewed about four points, and towed equally well as if end-on. These are all examples illustrating the bad manœuvring powers of ships of very light draught of water, and very great beam. Of course the formation of the bottom has something to do with it, but cannot remedy it. On the other hand I may instance the good qualities of the "Warrior" as a steering ship; not for turning quickly, but still for certain points in manœuvring she had very great advantage. On two occasions on one day while off Bermuda with the dock, on account of hawsers carrying away, the "Warrior" had to resume towing, we steamed close alongside the dock, threw a rope on board and took her in tow without lowering a boat, which I should be very sorry to attempt with the "Glatton," or even the "Thunderer;" she steered very steadily. I mention these cases as practical illustrations bearing on Captain Colomb's lecture: and I daresay he will be able to give them his attention and draw some useful conclusions from the irregular manœuvring powers of these short shallow ships and the better steering of the long deep ones.

Captain CURTIS: Yesterday I was somewhat edified by hearing a distinguished naval architect say that naval Officers knew more about ship-building than the architects themselves. I think he might have said "some." However, naval Officers are supposed to know when they have a good ship under them, just as a man does a horse in the hunting field, and I think they would know whether a ship is a good sea-boat or not. The manœuvring power of ships depends on the run of water, and its access to the rudder. I will start with the first curve, which is a cycloidal curve, similar to a curve the periphery<sup>1</sup> of a wheel in motion forward; a paddle-wheel also forms the same curve, and 'C', the neutral point that we have heard so much about, is a neutral theoretical point, I take it, similar to that of the magnet's lateral central axis which is at rest or neutral. With respect to the bow-rudder, I think it is very questionable whether the bow-rudder is of any use in steering a ship, with the exception of holding the water up. You will understand when the helm is put to port the pressure<sup>2</sup> is on the starboard bow, and the only use I see in the bow-rudder is in holding the water up, and checking the vessel's way. The ship will then be able to pivot more on her forefoot than otherwise. I have had some little experience of ships, of the gunboat class at any rate, and that was in the Quarantine Harbour at Malta: and I should say that they turned nearly on their forefeet—as nearly as possible, about one-third from the forefoot—and for manœuvring powers, I think if our naval architects would give us a ship in the form of a prolonged spheroid, or ovoid with pointed or tapered ends, with the greatest beam two-fifths from the bow, you would find those are the best manœuvring ships. I advocated that two years ago at the Society of Engineers. With respect to Thames ferry-boats, the only use I saw in the keel was to keep the ship to windward, and also in steering a straight and steady course. If you want to go

<sup>1</sup> "If it did not, there would be no friction."

<sup>2</sup> I offer an opinion directly the vessel answers her helm, the "superior" that pressure of water and fulcrum on which she turns is on the bow at right angles the stern-rudder is put over to.

round quickly, first cut away her forefoot, and her deadwood aft, and she will pivot more on the centre.<sup>1</sup>

Vice-Admiral Sir EDMUND COMMERELE, *B.C.*: Were you present at the trial of the "Candahar's" bow-rudder, and if so, what were the results?

Vice-Admiral DE HORSEY: I should like to ask the gallant lecturer if he can tell us presently what are the respective beams of the "Thunderer" and "Iris;" because, all other things being similar, we well know that the turning power of ships depends upon the proportion of length to breadth. I am glad that Captain Colomb has so clearly pointed out the motion of a ship's after body to the opposite side when first beginning to turn; it is a matter with which we are all conversant, although we have not had it so well demonstrated as Captain Colomb has now done. The figure clearly explains the reason that an inexperienced Officer, trying to leave a wharf under steam and helm alone, finds the ship at first move crab-like towards the wharf instead of from it, and perhaps smashes his quarter boats.

Captain NOEL: I rise more for the purpose of calling attention to the fact that we have amongst us a gentleman to whom Captain Colomb has referred, namely, Mr. Lambert; and I hope we shall hear some remarks from him on this all-important subject. I am afraid, as naval Officers, we find this subject rather too deep for us: I mean to say it is a subject we must study thoroughly before we can attempt to discuss it properly. I only hope Captain Colomb will give us some further remarks on the interesting experiments he made in the "Thunderer," as I am sure he has not nearly exhausted himself in this present paper.

Mr. LAMBERT: As I have been specially called upon it will be necessary for me to make a few remarks, but I hope it will be understood that as a landsman who has had no experience of the manœuvring of ships I speak from very little knowledge of the subject. Captain Colomb has alluded to the little communication I had with him in very pleasant terms, and I must say that although in his paper he disclaims any mathematical power, yet he has shown that he possesses the instincts of a mathematician: in many ways, and more especially in the beautiful experiment by which he has shown how the position of the instantaneous centre of rotation varies with the distribution of weights. It is a very difficult task to write a paper like this, but a very easy one to criticize it. Captain Colomb will forgive me, I have no doubt, if the criticism I venture to make is not in every respect a favourable one. There is one point in which I may be wrong; yet on which I am afraid I cannot agree with Captain Colomb, supported as he has been by Captain Curtis: I allude to the subject of paragraph 25. You will take it for granted that I profess to know nothing at all of the actual experience on a ship. I only claim to understand something of the operation of natural mechanical laws. It seems to me that Mr. White ought to be right in what he says as to pressure being on the lee bow. A well-known experiment will illustrate this to some extent. If a plate be dragged, by a string attached to its centre, obliquely through water, it will always tend to set itself at right angles to the direction in which it is being moved. That points to an accumulation of pressure on that part of the side, exactly corresponding to the lee bow alluded to by Captain Colomb. I am glad to see that I shall be relieved from any further explanation by the incoming of Mr. White, therefore, I leave the championship of his own views to him, and apologize at the same time for taking up what he will do so much better himself. There is one thing perhaps I might make one little suggestion about: it seems to me if the pressure were on the other bow, as Captain Colomb says it is, that this would be inconsistent with the result of the experiment of putting a false keel on the fore part of a certain steam pinnace to which Captain Colomb has just alluded. Captain Colomb stated that the effect of this false keel was slightly in favour of the rudder-power. If it assisted the rudder-power it seems to me that the pressure must have been on the

<sup>1</sup> The moot point is as to the pressure on the bow in turning; I have referred to the laws regulating solids in fluids: my conclusion is that directly the vessel answers her helm by the impressed water on the rudder, it translates the molecules that form the mass, across the line of keel, counteracting the forward motion in a measure—"Screw versus rudder," &c.

lee bow, and that is at variance with the view taken in paragraph 25. Captain Colomb alludes to the well-known experience that when the rudder is put over, the strain on it at first is much greater than afterwards. If during the latter part of the time, when the angular velocity of the ship is at a maximum, and, consequently, the resistance to rotation is greatest, the strain on the rudder is least, surely there must be some other force helping the rudder, and this can only be the accumulation of pressure on the lee bow. If it were otherwise, and the rudder alone gave the turning power, the strain on it should be greatest when the resistance to angular motion is greatest. I think Captain Colomb has attempted an exceedingly difficult task. It seems to me it is one only to be grappled with by the strongest mathematician. The circumstances are so complex, the data so varying, and their combinations so very numerous, that I think that the result you obtained from one ship might be entirely negated by experiments performed with another of different type. The length and speed of a ship; the distribution of its weights; the size of the rudder; and the circumstances of its being a balanced or an ordinary one; the time involved in putting the helm over; the nature of the propeller, twin screws or otherwise; all these things must have great influence on the turning powers of a ship, and the complications are so various that it appears almost hopeless for even the most experienced naval Officer to endeavour to trace the form of the curve which will be described, unless he be also a brilliant mathematician. I am sure, however, it is a good thing even for those who have no mathematical power to try and attack this question. Naval Officers—I speak chiefly from experience of the younger ones, and I hope the older ones present here will not be offended at what I am now saying—are accustomed to argue on mechanical matters from what is called common sense. This is a very carelessly applied term, and sometimes common nonsense would be more appropriate. They too often try to explain everything they see in a loose general sort of way, instead of adopting a sound reasoning, based on simple and infallible mechanical laws. I think the Service should be grateful to Captain Colomb for bringing this matter forward in the way he has done, for, even if he had done nothing else, he has called the attention of naval Officers to the fact that naval mechanical problems can be referred to natural laws. I am quite sure that battles will never be fought and the manœuvring of ships worked out by algebraical formulæ: and I am quite sure that the successful Commander in the future will be, as he has been in the past, the man with a keen eye, a tried experience, and a cool judgment. But I do believe this: that the Commander who understands the application of the simple mechanical principles which underlie the workings of the tools that he has to deal with, whether they be his ship, engines, torpedoes, or guns, will prove the victor when he finds himself opposed to an enemy who has not these advantages but is otherwise his equal.

Mr. WHITE, Chief Constructor: With your permission, Sir, I should like to make a reference to some matters contained in this paper. I must apologize, first of all, for not having been able to come before, but it was quite out of my power. In the first place I should like to say that Professor Lambert's opinion is entirely mine—that this is a question for experiment, and observation, and careful record by the Officers in command of ships. I said as much in a paper which I read here some considerable time ago on *the turning powers of ships*,<sup>1</sup> and the more I look into the matter, the more I see of the facts reported by naval Officers, the more I am convinced that this is true. It is true for this reason: we can write down charming mathematical equations, but we cannot fill in the quantities. We do not know how the water is moving relatively to the ship along various parts of her length, and what the dynamical effects of that motion, due to the change of momentum in the water, may be. But what we do know is that we can do a great deal in building ships to improve their handiness, and that the more facts we get as to the actual performances of ships, the more we are likely to advance that part of the subject which has great practical value. Now, it seems to me that this subject has two sides, with one of which I am very intimately concerned; in the other I simply take a spectator's interest. As naval architects we have to do with the considerations relating to the sufficiency of the

<sup>1</sup> See Journal, vol. xxiii, No. CI, page 557, *et seq.*

rudder-power given to a ship, and to the proper mode of handling the rudder; we have to ensure that under all conditions—so long as the ship is not badly damaged in her steering apparatus—that steering apparatus should have her under control. But when one comes to the actual manœuvring of vessels, and thinks of the endless combinations which the Commanding Officer has in his hands—the variations in helm-angle, in speed, or in the case of twin-screw ships in the motions of the propellers—the naval architect's part of the work appears small as compared with the naval Officer's. In all the ship's books of the Royal Navy, there is a valuable folio inserted, headed "Details on Turning Powers." It is intended that every Commanding Officer of a ship shall make trials of all kinds, and note the results for the benefit of his successors, who, of course, are at liberty to add to the number of those experiments and to the record of the results. Now, it is in that department of the work that we as shipbuilders have no concern at all except to read, learn, and digest as far as we can the results obtained. But when we get on such ground as Captain Colomb has properly taken this afternoon, then I claim to have the right as much as any naval Officer of joining in the discussion. This paper deals not with the practical management of ships, but with the theory of the subject, and I must say, without the least wish to be discourteous to Captain Colomb, that although his method of putting the matter may be more convenient to him to follow than any other, that method has been to me difficult to follow, and I will explain why. As a mathematician I am accustomed to use certain terms which have to me as clear a meaning as the alphabet; which have to Professor Lambert the identical meaning; which have to any mathematician in the world definite meanings. I come to this paper and I find in an Appendix a terminology with which I am not altogether unfamiliar, but which would be like learning a new language to me. I find a proposal to deal with the forces operating on a ship in a manner which I do not say is impracticable, but certainly it seems to me to be unwise, because the two fundamental principles which are stated so admirably at the bottom of page 2 on the paper,—the "often repeated, but I suspect not as often understood, principles of the motion of a rigid body,"—are stated only to be immediately afterwards departed from. Now, I do not think, after having stated these principles and having given them such a complimentary notice, that Captain Colomb treats them very well by immediately departing from them. As a mathematician I say that in accordance with those two principles the motion of a ship is entirely determined by the motion of translation of her centre of gravity, and by the motion of rotation, if any, about that centre of gravity. I think any one accustomed to deal with dynamical questions would prefer that mode of forming the equations of motion at any time, instead of attempting to do what Captain Colomb does, which is this:—He attempts to find out about what centre the ship is instantaneously turning, which centre, during the part of the motion which it is most difficult to deal with, is a changing centre, and he forms his equations of motion from instant to instant about a new centre of motion. Now, I do not know whether I have made the matter clear, but it complicates the problem as a mathematical problem immensely. If Captain Colomb, instead of forming the equations about the instantaneous centre had kept to what is a fixed point in a ship, the centre of gravity, and determined its motion, and then formed the equations for the motion of rotation about that centre, it would have been more in keeping with what we are accustomed to do, and, in the end, an easier method. But in whatever manner the equations of motion may be formed, they cannot be completely filled in. One may say that  $R$  is equal to the resistance; but when it is necessary to give  $R$  its value, I think we must all give that problem up. As regards the mode of representing the motion of the ship by the trace shown on the diagram, if I understand Captain Colomb aright, he considers the mode to be a new one.

Captain COLOMB: I mean a new way of putting it. The usual thing is to move the centre of gravity along the line, and gradually to turn it into the circular path instead of making it, as I have made it, passing away to the left of the line.

Mr. WHITE: That part of the trace outside the straight course is new, and that is the part in which I have a very deep interest. Now I understand what it is.

Captain COLOMB: I am sorry you were not here to follow the diagrams, because, as a matter of fact, I hardly touched that part at all.

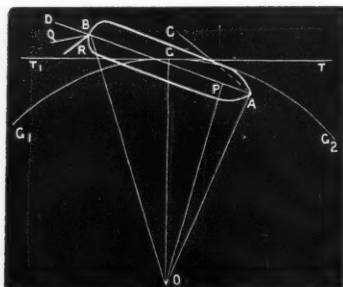
Mr. WHITE: I think I may say this in continuation of what I have been saying, that any one who will refer to the Report of the "Inflexible" Committee, and the Reports on the turning trials of the "Thunderer" made at Portland, will find that the diagram there drawn is, in the main, identical with Captain Colomb's; and I will say more than that, as it is a matter of interest in a historical sense, any one who will turn to the "Revue Maritime" for 1878 and 1879, will find that M. Risbec did the same thing for the "Elorn." Although I have endeavoured to keep abreast of the subject, I had entirely lost sight of some of the French experiments which, for accuracy of observation and record, are certainly, so far as I know, unsurpassed even at the present time. Turning again to that part of the curve which lies outside the straight course, I can quite believe that there is some motion of the centre of gravity of that character indicated; but I can also say that it will need an accuracy and a minuteness of the interval between successive observations to determine that motion accurately, such as has never yet been exercised. And when the motion is determined, I do not think it will be of very much practical value although it may be of scientific value. As a matter of fact we know from the "Thunderer" experiments at Portland, that when the helm was put down rapidly (in about 17 seconds), the ship swung off and acquired angular velocity in a most remarkable way. In the report on these experiments, the curves of angular velocity run up almost normally to the base line, indicating that the ship swung off very rapidly. Supposing instead of having steam steering gear, the "Thunderer" had had manual power, similarly rapid acquisition of angular velocity would not have happened in anything like the same interval. We know that the time of putting the helm over must influence the rate of the acquisition of angular velocity; and it is for that reason I do not think that the earlier part of the curve which Captain Colomb has sketched can have any great practical value. The nomenclature proposed in the paper for dealing with those curves appears to me unnecessary. If, as Captain Colomb has done, the diagrams are drawn to scale and the scale marked upon them, anyone who can use a scale and has the drift-angle indicated (as is shown here, and as was shown at Portland) can deal with the whole problem of the motion of the ship in space. The question whether a particular measurement shall be taken as a convenient mode of comparison between ships does not seem to me to be at all important so long as there is a complete record of the motion of the ship, and I should be delighted if in every Captain's ship's book in the Navy there could be found such curves as are to be found in the Captain's ship's book of the "Thunderer." I hope the time is coming when that will be done. As to the method of observation, so far as I am informed about it it is identical in principle (I am not speaking of the details of management) with what was used at Portland and by Admiral Bourgois, in the most important of his experiments of 1864-66, except that Admiral Bourgois did not obtain an accurate record of the initial movements of the ships. The fact that this method has been used by so many independent workers, is good evidence that it must be one of the best possible, and we all know the care and ability with which, in the "Thunderer," Captain Colomb organized and carried out what I cannot help regarding as an unrivalled series of trials. There is one other matter which I should like to say a word about, and it is this: To what extent should the designer be influenced by the records of these trials? Take as an extreme example, the question of trimming by the stern, to which Captain Colomb alludes. The effect of the draught upon handiness in sailing ships, of course, has been recognized time out of mind, and I have heard Officers make statements which I suppose were correct, but which were certainly difficult of explanation, as to the influence upon performance of comparatively slight changes of trim. But when we come to steamers, what are the facts? We are obliged, in obtaining a certain speed, to work within certain limits of draught. When we have a ship like the "Bellerophon," for instance, which was to be of moderate size and high speed, for her dimensions, and consequently required a large power, how was that power to be applied? It could be supplied according to the lights of those days—I am not saying I endorse the opinion—only with a large screw. That ship was given considerable draught by the stern in order to immerse her screw; and she is an example of what I mean when I say that the designer has to work within many limitations; what he might think to be wisest he is not always able to do, and he

cannot influence the subsequent management of the ship. Take, for instance, the question of change of trim due to the burning out of coals and the consumption of stores aboard. Who is the person that can influence that most in these days? Not the designer but the Captain of the ship. The Captain of the ship has in his water ballast the means of regulating trim in a very large degree, and if, as is not at all unlikely, the ship is made better by not being so much by the stern, the Captain of the ship is the person to see that she is not by the stern more than necessary. The designer's difficulty, often, is to get everything into the space available, and to obtain the desired trim when a ship is laden over the change of trim resulting from the consumption of coals or stores, the designer can frequently exercise but little control, except by putting into the hands of the Commanding Officer the possible use of water ballast. It is well known that in certain special vessels where handiness was of the greatest importance, as in the "Polyphemus," the after part of the keel and deadwood have been cut away.

Captain COLOMB : And the forepart also.

Mr. WHITE : Yes. Now about this supposed injurious effect of cutting away the forepart. I noticed that Captain Colomb says he put a small piece of false keel on to his 37 feet pinnacle. I do not think Captain Colomb told us what the size of that false keel was. I simply wish to point out that if a full-sized ship was treated in the way that 37 feet pinnacle was treated, we should have to make very large additions of false keel. The illustration was extreme. Of course it may be said extreme illustrations show the tendency of a change, but they must be remembered to be extreme. In the "Polyphemus" the forefoot is cut away; and in that case I believe the forefoot being cut away will be an advantage, and I will explain why. It illustrates the distinction of view which I entertain from that expressed by Captain Colomb. It must be remembered that Captain Colomb's pivoting point is a point which is not always in one place. During the earlier motions of the ship, when she begins to swing away after the helm is put over, there is no doubt that the pivoting point is near the middle of the length, the drift-angle not having attained large values. During this early part of the movement, therefore, any change of form which enables the ship to rotate easily is an advantage: and cutting away the forefoot is such a change. Most of the White Star and other Atlantic steamers have their forefeet cut away to increase handiness: and Mr. Harland has told me, as the result of his extended experience in the working of these ships, that he considers they could not have been dealt with as they are at low speeds going in and out of the Liverpool Docks, if they had not had their forefeet cut away. I think that is a weight of opinion and experience which requires to be considered in dealing with this question. We have on one side the experiments with the 37 feet pinnacle with its additional false keel hanging to it; we have on the other side indications that in at least the earlier parts of the motion, or when turning with little headway, the diminution of the moment of resistance must facilitate the acquisition of angular velocity; and further, there is the experience of the great ocean steamers. On the whole I am, therefore, disposed to believe that we have done wisely in cutting away the forefoot of the "Polyphemus," as well as the after deadwood. Now, as to the pressure on the outer bow. Take a case which is not an imaginative case, but an actual case of which I have had full details. A very handy ship was found to have so large a drift-angle that when she was turning at uniform speed, the "pivot point" was before the bow. In that case the pressure was undoubtedly on the outer bow; that is to say, in that case the conditions are identical with those which I thought held good generally when I wrote six years ago on this question and without any exact knowledge of the values of drift-angles. Now, take the other case, a ship with smaller drift-angle, that is with her bow not turned so much within the tangent to the path of her centre of gravity. This is the case of the "Thunderer." The pivot point (P) is abaft the bow (see diagram). Suppose that OA joins any point A before the pivot point with O, the centre of the circle, and that AC is a line drawn at right angles to OA. Then the angle PAC is the drift-angle at the point A. It is quite evident that there will be no drift-angle at P. Anywhere before P we have a drift-angle on one side of the keel line and anywhere abaft P on the other side of that line. That is to say, in passing through the pivot point the drift-angle changes its sign. If we could put

below the bottom of the ship a series of little balanced rudders, the chances are that at any point between the bow and P, a balanced rudder would stand about square to the line joining its axis with the centre (O) of the circle. That would be



true, but to what extent? Only to this extent represented by the length AP, as compared with the total length of the ship. In the case of the "Thunderer" the pivot point was about 100 feet before the middle of the length. The "Thunderer" is 280 feet long, and the pivot point was, therefore, only 40 feet abaft the bow. For 240 feet, therefore, of the length of the ship, the condition holds good that the excess of pressure is on the outer side, the relative flow of water being towards the centre of the circle; whereas for only 40 feet length of ship does the other condition apply, the relative flow of water being outwards, as Captain Colomb has shown it to be by experiment. I ought to say that before I heard of Captain Colomb's experiment, I had worked out this case from my own knowledge of actual drift-angles, and I should add that the chances are that the balance of pressure will still be on the outer bow, even in a case like the "Thunderer's." In most ships of war, with their great rudder-power, quick turning, large drift-angles, and ordinary ratios of diameter of their circles to the lengths, the pivoting point is so far forward that the balance of pressure must, I think, be on the outer bow, and if so must assist the rudder. I think Captain Colomb and myself will now be very nearly at one on that point. One other point and I have done. Suppose I apply the construction in the previous diagram to the rudder—it will be possible to explain a circumstance to which Captain Colomb has drawn attention, but of which I do not think he has given an explanation. In the diagram BR is the rudder; and BQ is drawn perpendicular to the line OB. Then DBQ is the drift angle at B. The effective helm angle is the difference between the DBR which the rudder makes with the keel, and the drift-angle DBQ; and so when in turning the drift-angle is increased gradually, I can quite understand that a relief from pressure on the tiller occurs when the motion has become uniform. No one sympathizes more strongly than I do with Captain Colomb in his wish to put this subject of the turning powers of ships on a proper footing. We have dealt with this matter together on many previous occasions, and I hope there will not be the least doubt entertained that I have the greatest respect for Captain Colomb's experience and opinions, even if I do not entirely agree with him.

Commander RICHARDS: I hope that when Captain Colomb has dealt with the scientific part of this question, he will devote a short space to the "pilot" knowledge of this subject. That a ship with a right-handed screw, going ahead, turns faster to starboard than to port; that in a tide-way she will, under certain conditions, turn faster by going astern—these facts, and many others of a similar nature, come within the pilot's knowledge, and have not, as far as I am aware, been put in a complete form by any writer.

The CHAIRMAN: I believe it is my office not to enter into controversy, but as far as possible to harmonize any feelings of disagreement that there may be, if any.

which I hope is not the case here. There are two points that I have been very much struck with in this lecture. The first is the great debt of gratitude we owe to Captain Colomb for having started a topic so very important as the manœuvring powers of ships, and for the very great industry which he must have devoted to it in order to enable him, in the press of official work, to draw up this lecture which he has submitted to us. The other point is, I think we shall all allow that this is a mathematical question chiefly. As he has put it before us, it is a mathematical question, and we are very much indebted to two mathematical gentlemen for what they have said. We have all heard the old proverb that the cobbler says, "There is nothing like leather." I am a cobbler—and a practical one—and the conclusion I draw from this is that this is a subject that we would all be glad to be able to discuss, if we could, from the mathematical point of view, and that we should impress upon the younger members of the profession the desirability of going to Greenwich, where they can acquire the mathematics which would enable them to do so. There are one or two points which I should like to express my views upon. One is as to the pressure of the water upon the bow of the ship. My ideas are entirely in agreement with those of Professor Lambert and Mr. White; but looking at the matter in a different point of view from that in which they have regarded it, what I see in this diagram is this, there is one force (P) coming to the left: that is the only force, as far as we can see, that is shown there. Accordingly, if that force is pressing to the left on the bar BA, it necessarily tends to drive that bar to the left; but it does not drive all parts of the bar to the left. The upper end of the "B" is driven to the right; and we all know practically that when a ship is turning it is not only her stern which turns, but her bow: the bow moves to the right while the stern moves to the left. There must be some force on the outer bow, and it appears to me that the resistance of the water must be the thing that turns it. There is another practical recollection which we shall all have if we go back to our early days as midshipmen. There was the question about the ship flying up to the wind when we put the helm down, and that she flew up so much faster as the pressure of the wind increased. What was the reason we were to give? Why, the pressure of water on the lee bow—the outer bow. If the pressure of water as the ship turned round was really on the weather bow, as we have been told, then, in fact, we should not have found that ardency—I think that was the old term—which did actually exist in ships. It is quite true, as the ship came up, we saw the waves breaking off the bow, as Captain Colomb says he did from the "Thunderer;" but it does not follow because we see an apparent motion in the upper part of the water that therefore there should not be considerable pressure below water on the other side, as we saw when looking at that bar; will anybody tell me what turns that bar to the right if it is not that pressure? Captain Colomb, I am sure, will be glad to reply to the remarks that have been made. There is no other point on which, I think, he and Mr. White are inclined to disagree, and I should like to remind him of one thing. As far as my recollection goes, there was no vessel we ever dealt with which was considered more handy than the Bermudian boat. What is the characteristic of that Bermudian boat? It has a very long heel and no forefoot, therefore it seems to me that this question of cutting away the deadwood commends itself to our experience; and, at the same time, what Mr. White says appeals also to my experience. Take off the forefoot, and the boat will turn all the faster.

Captain COLOMB: My feeling is this, that if I had talked comparative nonsense, that nonsense would have been compensated for by the discussion which has taken place, especially by the admirable remarks that have fallen from Mr. Lambert and Mr. White. I cannot help feeling that the Institution is greatly indebted to these two gentlemen for speaking as they have done to-day, and I feel proud to have been the means of producing the discussion which has followed. Admiral Boys spoke of the pivoting point being fixed in the water plane. I think it would be difficult to go into further discussion now. If my paper is read with the diagrams, perhaps the best answer to the question will be found there. I have treated it in point of fact in both ways, both as fixed in the water plane and as moving. I quite agree with what Admiral Boys has spoken of with reference to the "Warrior," and I drew your attention to the conditions of the "Iris" and the

"Thunderer." The "Iris" is a very handy ship at very small angles, but is very much the reverse when you come to large angles, occupying a large space and time in doing what the "Thunderer" does in a very small space and short time. The difference is that the "Iris" answers her helm quickly, and the "Thunderer" slowly. It occurs to me that as far as we have got, we seem to be between these two difficulties, that if we want a ship to answer her helm quickly through small angles she will be slow through large angles.

MR. WHITE: The "Iris" is a ship that has a very small rudder area, that I think was the reason.

Captain COLOMB: I have not the rudder area by me, but I have taken care in my remarks to show that there might be other causes. It does not in the slightest degree destroy my argument in this particular instance. I think Mr. Lambert spoke of using the data from a single ship. I quite agree that you ought not to rely on the data from a single ship. The "Iris" is only an illustration, and I am really using the data of many hundreds of experiments from seventy or eighty ships. Long before going into these matters I got the kind permission of the Admiralty to examine their records, and I entered upon the examination of quite 300 experiments before I tried any myself at all. Admiral Commerell spoke of the "Canada's" bow-rudder. We have not had any trial of the bow-rudder yet, and it would be useless to speak until we know something about it. We have had just a preliminary trial, but the gearing did not work well, and it was impossible to make any proper comparison, therefore, any remarks that I might offer might have subsequently to be recalled. Admiral de Horsey spoke of the turning powers depending upon the beam, and referred to the beams of the "Thunderer" and the "Iris." I am not quite sure that I understand the question as to whether the beam very much affects the turning powers. I do not know how that is, but the "Iris's" beam is only 46 feet, and the "Thunderer's" is 62½ feet. Mr. Lambert was good enough to compliment me on showing this batten experiment on the paper, but I cannot accept the compliment, because it was suggested to me by Mr. Marten, my First Lieutenant. I was very much struck with it, and thought it would be a good illustration to use. Mr. Lambert and Mr. White both attack the pressure on the lee bow. There is no question but that is one of the things we have to get at. With what Mr. White has said on that subject, I do not feel myself at all in disagreement. When I have stated that the pressure is not on the outer but on the inner bow, I have confined myself entirely to the state of things on the final circle. In point of fact, I think when you come to read my remarks, you will see that I am under an impression that the pressure is on the outer bow at first and then changes, and it is that change of pressure which changes the position of the pivoting point, so that there is not really any disagreement between us. Mr. Lambert, I am quite sure, does not mean to say that the following out of these problems is an improper thing. We ought to work them out and to have hypotheses, even if these hypotheses are wrong, because until somebody puts a complete hypothesis—which I have endeavoured to do—for the whole turn, we shall not know how to attack the problem. The object of the paper is that; and numbers of naval Officers I hope will get hot and angry with the writer of the paper and will endeavour to prove that he is wrong by experiment. That is what my aim is.

MR. LAMBERT: I said that although I thought the attempt was almost a hopeless one, yet that the effort could not but be productive of much good.

Captain COLOMB: I should wish to endorse entirely what Mr. Lambert has said about the experienced judgment, quick eye, and all the qualities which make a seaman. I would not give you much for any amount of theory if it were not to assist the eye and the judgment of the seaman. I do not care about anything else. Mr. White began his most interesting observations by saying that this was a question for experiment and observation. There is no doubt about that, and the object of this paper is to stimulate experiment and observation. I have spoken of the value of hypotheses, and nobody knows the value of hypotheses better than Mr. White himself. The variations of helm, and speed, and screws, &c., are matters under our control, but they are not so much under our control as we are apt to think. These definite laws control the motions of the ship,—much more completely as far as I have gone than I thought until I commenced the experiments for myself, and I think the

knowledge that they are not so indefinite as you may be inclined to think them, will throw upon the naval architect the task of endeavouring to facilitate in every possible way manœuvring power, so as to give us that control which we have not already got. Mr. White is hard upon me for my terms in the Appendix. I shall be very glad if he will give me some better terms, but terms of some sort are an absolute necessity. Admiral Boys said that the area of the middle line plane under water, and its length as compared with its depth, is a great element of turning power, but there is not any name for it unfortunately, and I have given it one which Mr. White does not like. "Motion about the centre of gravity." I am obliged to approach it from my own point of view. It may be true for a mathematician, that to approach it from Mr. White's point of view is much more clear and definite. I, not being a mathematician, am obliged to use terms which appeal to my own mind, and also seem to appeal to the minds of ordinary naval Officers with whom I have talked these matters over. I am accused of stating principles and then departing from them. It may be I have done so. I know the difficulty of the subject is such that it is quite possible I may have fallen into that error. Mr. White spoke of the experiments for the "Inflexible" Committee, and I must always continue to admit that I drew my knowledge originally from these trials. I do not agree with Mr. White that the French trials preceding them were better.

Mr. WHITE: As good, I said.

Captain COLOMB: I am not disposed to think even that; but still I must say, for my own credit, that these definite positions of the ships at 4, 8, 12, and 16 points are new, and that the method of tracing the early turning powers of ships is new. You will not find these in any French experiments, or any experiments made by the "Inflexible" Committee, or anywhere else. I was in communication, when I was in the Mediterranean, with French Officers who carried out experiments in France, and they quite agreed that this method was a better method on all grounds. The trials made before the "Inflexible" Committee also are defective, inasmuch as they do not give the point at which the helm began to move.

Mr. WHITE: That is obtainable from the data, and will be found in my paper of 1879.

Captain COLOMB: I was in close correspondence with Mr. Watts when examining into these trials, and we both agreed that there was a flaw, and that you could not obtain that information.

Mr. WHITE: I do not in the least wish to contradict Captain Colomb: all I meant was that the original straight course of the ship was indicated in the diagram, that the accompanying diagram gave the interval between the time of the helm beginning to move over and a certain spot on the curve, and it was perfectly practicable to work back within very narrow accuracy to the starting point.

Captain COLOMB: We both tried to work back and failed. Mr. White drew attention to the conditions of the "Bellerophon," and, of course, one quite understands that there must be draught when you require a screw of large diameter. You must have draught by the stern, but Mr. White, of Cowes, shows us in his torpedo-boats a method of getting over that, and I cannot help thinking that very soon we must try some experiments of that nature on a larger scale. It is very probable we may find methods of getting manœuvring power by cutting away the deadwood abaft, so as to make up for that draught of water sometimes forced upon us. About the *small* piece of false keel, of course that is a relative term. It was 2 feet by 3 feet. The boat was 37 feet long and 3 feet mean draught. It really *was* a small piece, but small or large it was merely an illustration of the effect of putting a keel forwards and putting a keel aft. I think Mr. White especially and Mr. Lambert, when they come to look at the letterpress with the diagrams, will see that I have avoided some of the pitfalls into which I may be supposed to have fallen. I am certain I have not avoided them all, but I will take care that I do not fall into any more pitfalls by continuing my remarks to-day.

## AUTOMATIC JALOUSIES.<sup>1</sup>

Invented by Major J. E. Bale, 1st W. I. Regt., Associate Royal Institute of British Architects, late Colonial Surveyor Gold Coast, Africa, and formerly Acting Engineer, Royal Engineer Department, West Coast of Africa (from February, 1867, to November, 1870).

JALOUSIES are the usual expedient to exclude excessive light and heat, and admit air to buildings in all tropical or hot climates; but those in use in the West Indies and Africa, and in America, are similar in construction and adjustment, and easily damaged or deranged; the most vital objection being the time required to close a number of them where only a few hands are available. Long ranges of verandahs get swamped in case of sudden rain storm, and in variable weather they require constant attendance. They are a constant source of expense for repairs through accidental injury and loss of fitments. The automatic jalousies may be set to any initial pitch to weather, or to act as sunshades, work by themselves, and may be kept closed by unshipping the counter-balance, or by placing a disc of wood under the weight to put the jalousies out of working gear. There is no liability to damage or derangement, only fair wear and tear.

1. These jalousies were originally designed for the additions to S. George's Cathedral, S. Vincent, West Indies, according to plans and specification furnished by me as architect, by directions of the Lord Bishop of Barbados and Windward Islands, West Indies.

2. They act according to pressure of wind upon them, regulating the current of air admitted by the windows, and in a very high wind will close entirely; they also exclude the rain when driven against them by the wind. Their action is smooth and noiseless.

3. Constant light is provided by glazed heads within the window arches, or by alternate panels of glazing and jalousies, or the louvres, or blades of the jalousies, may be metal frames filled with dulled or toned glass; all flapping and jarring being obviated, the glazing is not liable to be cracked or broken from those causes.

4. The complete action of the jalousies is produced by a counter-balance weight acting equally in each louvre; the weight is in three gradations, or sections, which are brought successively into action, and accumulate resistance in proportion to the force of wind on the louvres. The speciality of this action is elucidated by a working model submitted with this description.

5. Spring balances may be used to effect this object, but counter-balance weights are the most simple, durable, and efficient in tropical climates, and where native servants are employed. Steel or iron

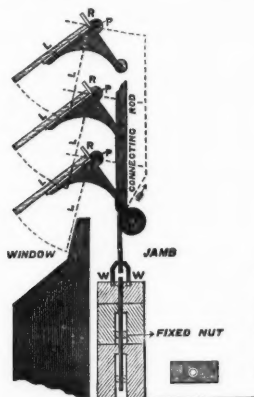
<sup>1</sup> Shown and explained at the meeting on February 10, 1882, Lieut.-General Sir Beauchamp Walker, K.C.B., in the chair.

rapidly corrodes in the damp season, and always where exposed to saline air or vapour from the sea, and springs, &c., cannot easily be replaced, repaired, or adjusted by the local artificers.

6. The louvres may be pivoted as in the model to work lightly, and fewer louvres are required to fill the window space or pivoted at the upper edge, as per drawing. The pins or pivots of the louvres may work in fixed window frames or the stone jambs of the windows, as in the case of S. Vincent Cathedral. Louvres of any size or proportion may be fitted with this action.

7. These jalousies admit of architecturesque treatment. When coloured externally of a dark grey they are scarcely distinguishable from glazing at a short distance; internally they admit of decoration to be only second in effect to stained glass.

Detail Drawing—scale  $\frac{1}{16}$  size—of Automatic Jalousies, louvres shown in section, and rain-guards to ditto, "R"; pivots at ends of louvres, "P"; and connecting-rod by window-jambs. Seen in elevation; counter-balance weight, "in section," at rest.



Section of weight showing how it may be adjusted by nuts and screws, to give play to the lightest or heaviest balance weights, i.e., No. 1 or 3. The nut at centre is fixed.

Soffit weight.

Dotted lines L. L. L., &c., show position of louvres, connecting-rod, &c., when closed.

W. W. counter-balance weight in 3 sections or gradations. This weight (or weights) may be put out of sight, or can connect with and regulate louver lanterns on roofs of buildings, or windows out of ordinary access, the weights only being within reach to adjust if needed.

Captain LEGGETT: I have frequently suffered from the inconvenience of jalousies, and I must say I think this is a most reasonable and suitable invention and well calculated to meet that difficulty. Of course I have not had time to study it, but I think there is very little fault to be found with it in any shape or form. That is what strikes me as a casual observer.

Mr. PFOUNDSE: May I ask if you propose to fix your jalousies to movable shutters or only to fixtures? In Australia, China, Japan, &c., most of our jalousies are movable shutters, and the weights and other mechanism might require to be on a small scale.

Major BALE : You mean as we have also in the West Indies, a range of verandahs opening as casements ?

Mr. PROUNDE : Like ordinary shutters opening outwards, on to verandahs.

Major BALE : In those cases where you have them opening at ordinary times, I should not consider that essentially necessary, for if the weather were doubtful you would have the jalousies in the shutters closed while the weather was unsafe. But for ordinary ranges of verandah, where you want a large quantity of air to be admitted where the jalousies are movable but in standing frame, the action comes in. For instance, in the Island of Barbados a large asylum was to be built ; they wanted a great deal of air in the building : the great difficulty was what was to be done. They must have jalousies and in large numbers, but the objections I have just stated to you were urged against the use of them, and the matter was unsettled when I left. I think with the shutters smaller weights might be used, but in most cases I should be disposed to leave them out altogether. It is only for the movable jalousies and standing frames, church windows, and so on that I should recommend them.

General HERBERT : There is one point that has not been mentioned. We know the difficulty of closing the windows all over the place in the case of a hurricane. Now, this simple arrangement would apparently obviate that necessity and save an immense deal of time and destruction of property.

Major BALE : I did not anticipate a hurricane, but I have proved the effect of jalousies in a hurricane. Buildings that were guarded by jalousies round the outer walls withstood the hurricane of 1865 in the Bahamas, by softening the wind through them, something as a stack of faggots round them would have done, when solid walls were blown in. The sudden effect of a gust of wind upon these does not act as upon a solid wall. The jalousies take some few seconds closing ; they gradually close against the wind ; they act of themselves, and do not admit a flood of water, and damage is not done by it. I merely alluded to that quality in them, when I said that in long ranges of verandah we get swamped out by a sudden rain storm, driven by the force of the wind, before people can close them. I can prove how safe they are in a hurricane, but certainly in this case you have been kind enough to amend a great omission I made, that in the case of a hurricane these things would act with perfect safety and certainty.

The CHAIRMAN : I have to thank Major Bale, in the name of the meeting, for having brought his useful invention to our notice.

## WALLACE'S INTRENCHING TOOL.<sup>1</sup>

By Major N. W. WALLACE, 1st Battalion, K.R.R. Corps.

It is not my intention this afternoon to take up the few minutes allotted to me in advocating the absolute necessity for shelter in the field from modern breech-loading fire.

This is admitted by all who have studied the question.

Taking that fact as my starting point, I will go on at once to show how, in my opinion, such shelter can be gained in the quickest and most effectual way.

Foreign nations long ago became alive to the importance of the matter, and all are more or less ahead of us in their preparations; Germany being, as far as I can ascertain, the most, and Italy the least, advanced.

All are provided, though in varying proportion, with intrenching tools, carried either on mules or by transport, or on the person.

You will have seen that Russia has lately greatly increased the number carried per regiment, having, I suppose, learnt experience from the obstinate defence of the Turks when intrenched: indeed it is said that the want of tools was so severely felt, that the men were driven to use their cooking utensils as substitutes. The Linnemann has now been adopted by them.

The Northern and Southern Armies in America, owing to their constant employment of the spade on every possible occasion, were christened "the masters of the art of digging." And it was said, I believe, of the Austrians that "a soldier would sooner part with his rifle than his spade."

Hitherto our army has entirely depended on pioneers, and on such field-intrenching tools as our generally overworked transport might be able to supply.

I hope that this will be the case no longer, but that soon we shall see each soldier made self-dependent, and confident that by the use of the spade he carries, he can hold his own against superior numbers of the enemy in the open.

This can best be attained by making shelter-trench exercise a part of the regular duty of every soldier, and by always practising him in it, not only through the year, but especially during the period of his musketry instruction, so that digging and firing may be combined, as would be the case on active service.

I need hardly say that this should be encouraged in our Reserve Forces, upon whom, in case of invasion, the safety of England would so greatly depend.

<sup>1</sup> Read at the meeting on 9th June, Lieut.-General Lord Chelmsford, G.C.B., in the chair.

Various sorts of light intrenching tools have been invented, and many of them tried. Some have failed from being too complicated, some from being too heavy, others from want of strength.

At last the choice seemed to lie between the Linnemann or Roumanian, and the S. M. E. pattern spade. I was fortunate enough to witness, and in one instance to have to report on, the performances of those spades when issued for trial.

The chief advantage of the Roumanian spade appeared to be its portability, but except in soft ground, it was useless.

The Engineers' pattern, with its pointed blade and longer handle, seemed more suitable for various work; it was, however, apt to buckle up at the end, and to lose its crutch, whilst in the use of both spades, and especially in the Roumanian, the men's knuckles suffered greatly.

These trials taught me what were the essentials of a really serviceable intrenching tool which may be summed up in four words—

*Strength, Portability, Handiness, Power.*

The tool should be adapted for use in every kind of ground, rocky or soft.

Be able to cut roots and lever up stones.

To break open boxes and barrels, and, at a *pinch*, loophole walls.

The tool which I have the pleasure of showing you this afternoon has passed through these tests under the supervision of Col. Sir Andrew Clarke and the Royal Engineers' Committee.

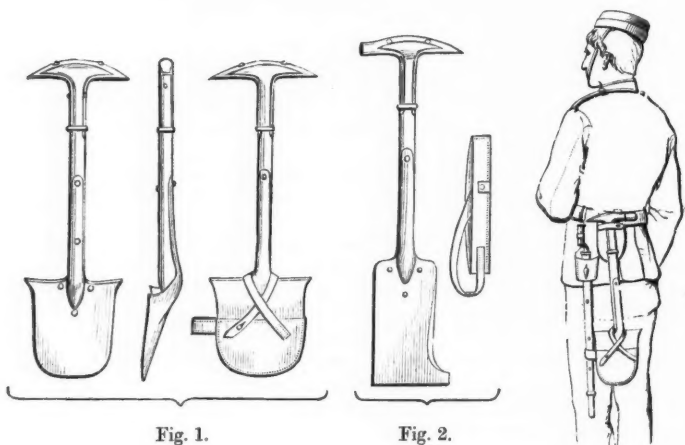


Fig. 1.

Fig. 2.

As a specimen of these official trials it will be enough to say that in ordinary soil a shelter *pit* was dug in six minutes, and a shelter *trench* in twenty minutes.

On a consolidated parade ground one hour proved enough for the regulated trench; gun-pits and epaulements were thrown up, and, as an experiment, a 14-inch brick wall, strongly constructed, was loopholed in forty minutes.

The proposed trials on a large scale which I am glad it will have in the coming manœuvres will doubtless yield some useful hints for further improvements of the tool, and my suggested mode of carrying it, which I shall gladly avail myself of, whether I am permitted to have the advantage of witnessing the manœuvres or not.

I suggest it will be found useful, not only for cavalry—where it saves considerable weight—and infantry in the field and camp life,—for marines and naval brigade on shore, but also for steam launches, for mining purposes, and for carriage or gun limbers.

I have also adapted it for the use of the Ordnance Survey by the addition of a hammer and bill-hook (Fig. 2), and in this form I think it could with advantage be carried either by the pioneers, or by a proportion of the rank and file.

In conclusion, let me say that I do not propose that this small tool, weighing about  $2\frac{1}{2}$  lbs., and measuring 23 inches in length, should take the place of the heavier and more powerful Service pick and shovel: still less do I claim for it *perfection* or indestructibility.

A tool so limited in weight and size cannot reasonably be expected to bear *anything* and do *everything* which the British soldier may be pleased to require of it; simple as it looks it is not so easy to make. But I do not hesitate to say that when made with care, and of the best material, as are all which my contractors, Messrs. Lucas & Son, have turned out, it is a *marvel* of strength and *power* for its size and weight, and most convenient for its handiness and general adaptability, and I am sanguine that it will fulfil my expectations and justify the good opinion formed of it by the many friends who have taken an interest in it, and by the civil and military engineers who have tried it.

The thanks of the meeting were voted to Major Wallace for bringing his invention to their notice.

NAMES OF MEMBERS who joined the Institution between the 1st April and 15th June, 1882.

#### LIFE MEMBERS.

Donner, C. S., Lieut. R.N.	Harter, S. J. H., Lieut. Royal Horse
Gairdner, Innes, Lieut. R.N.	Guards.
Short, H. M., Esq., late 17th Regt.	Combe, C., Lieut. Royal Horse Guards.
Jervoise, E. P. E., Lieut. R.N.	Jones, C. H. P., Lieut. R.N.
Lake, B. G., Capt. 3rd Middlesex	Fenner, E., Capt. 3rd Middlesex Art.
Rifle Volunteers.	Volunteers.
White, H. G., Col. Royal Scots Regt.	

#### ANNUAL SUBSCRIBERS.

Hand, J. S., Col. h.p.	Richards, W. C., Capt. 1st Exeter Rifle
Downes, C. V. S., Capt. East Lancashire	Volunteers.
Regiment.	Wood, L. E., Major (h.p.) 54th Regt.
Mansel, W. L., Capt. South Lancashire	Ricardo, A. D., Lieut. R.N.
Regt.	Cardale, C. S., Capt. R.N.
Lovegrove, E., Capt. Northampton Regt.	Hoskyns, Chandos, Capt. R.E.
Shervinton, C. R. St. L., Capt. Cape	Boyes, W. J., Major h.p.
Mounted Riflemen.	Hornby, L., Major East Surrey Regt.
Henderson, F. H., Lieut. R.N.	Thornton, F. S., Lieut. Rifle Brigade.
Baden-Powell, B. F. S., Lieut. 3rd Batt.	Downing, C. M. H., Capt. R.A.
Essex Regt.	Wickens, S., Capt. 3rd Middlesex Art.
Darwin, C. W., Capt. Durham Light	Volunteers.
Infantry.	Short, E. G. M., Lieut. Leinster Regt.
Matthews, J., Vet. Surgeon 4th Hussars.	Pusey, E. B., Commander R.N.
	D'Arcy, John, Capt. R.N.

#### *Erratum in No. CXIV.*

The note of interrogation at p. 94, line 14 from bottom of the page, is a printer's error. Colonel Lonsdale Hale has requested the insertion of this erratum, as the query referred to implies a sarcasm, quite unintentional on his part.

## OCCASIONAL PAPERS.

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Lieut.-Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

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### NAVAL WARFARE AND THE MILITARY PORTS OF FRANCE.<sup>1</sup>

By Rear-Admiral AUBE. Translated, by permission of Messrs. BERGER-LEVRULT & Co., by Lieutenant HASTINGS R. LEES, R.N.

OUR time is an epoch of transformation, of passing from an old order, slow to expire, to a new order slow to assert itself. The war of new against old ideas has lasted a century, and yet how distant seems their actual victory. Of social institutions, the practical realization of these ideas, some, profoundly or deeply shaken, are henceforward without strength. The others have not yet found the powerful foundations which they require to fully develop their fertilizing action. Doubt, incertitude, exist in all minds, when the national security and greatness are in question. Does not the organization of the army still remain a problem for whose solution, still delayed, the country has anxiously awaited for ten years? It is said to be near, we admit, but France, to find herself once more with her war strength, must be able to rely on a navy which, even in times of peace, makes its civilizing influence widely felt, as well as on her army. Does our navy satisfy this absolute necessity? The legend of 1870-71, false like all legends, has long ago lulled us with its illusions. As far as fundamental institutions went, at least, our navy seemed to escape this general law of renovation which sways us at present. Was this really true? The question has just been loudly put with a sincere echo in the maritime world, by the transient tenure of power of a man of ardent and determined mind, who derives from his patriotism this double force, so rare now-a-days: faith in his ideas and the will to carry them out against all obstacles. His appearance of one day as Minister in the Rue Royale will at least have had an active result; his projects of reform have been given by their author a publicity which would seem to demand profound and general discussion. We will only discuss here one of the ideas raised by this vast programme. For an idea of economy and simplicity of action, the existence even of the military port of Rochefort (Colbert's

<sup>1</sup> *La Guerre Maritime et les Ports Militaires de la France*, par M. le Contre-Amiral Aube. Pamp. pp. 38. Paris, Berger-Levrault & Co., 1882.

NOTE.—It is right to state that owing to Lieut. Lees' sudden departure on appointment to H.M.S. "Swiftsure," the proofs of this article were not revised by him. Revision has been carried out where apparently necessary.—L. A. H.

creation) was threatened. Reason seems to us to attach to it renewed importance, which the future can only increase. Do not let us err here. The question is worth being studied with all the developments which appertain to it.

### I.

The object of all navies is naval war. The fundamental problem which devolves on us in our researches before all others is then, what will a naval war be? Curious idea! no one at present, not even the most distinguished seamen, can answer this question. I add, none amongst them can really say what will be the real fighting implement in such a war.

This double assertion requires proof. Does it not seem a pure paradox, when not only England, for whom maritime interest is of the last importance, but every nation in the world, spends every year, and has done so for more than thirty years, fabulous sums for the maintenance or development of their navy? England has her "Inflexible," Italy her "Duilio," France her "Dévastation"; and not one of these formidable engines of war, where bronze, iron, steel, are accumulated in all shapes, is a definite type of the fighting ship of the future! and their *réunion* would not constitute one of those fleets powerful, if not invincible, on which a nation could, as heretofore, rely in perfect confidence for the protection of its commercial interests, and the security of its maritime frontiers. If it is thus, if this double end is not attained, if this expenditure is to no purpose, and these long and persevering efforts are in vain, what use is there in continuing on a road which has no ending? But then what are the causes of this supposed impotence of the actual war fleets to insure these superior results, and of their inferiority in regard to fleets of former times which amply sufficed for them?

These causes are many; let us try to prove those whose effects appear decisive.

Less than fifty years ago, the epoch of sailing ships, the only one which has a history, all naval force, whatever its importance, was essentially a *réunion*, more or less numerous, of fighting units (ships of the line), realizing, with more or less perfection, a type, ideal but precise, that builders of all nations strove to attain. What was this fighting unit, this ship of the line? It was a floating wooden fortress: four batteries of 30 guns, of a similar calibre in later times, ranged one above the other, pierced the exterior white streaks of their sides. Taunt masting, on which was spread to the wind three pyramids of sails, the trimming and management of which was a special science, gave to the huge mass a speed rarely exceeding 12 knots, and which at most differed a knot in any two vessels; lastly, in the part below the water line, the holds, were accumulated, arranged in most perfect order, munitions of war, spare stores, provisions, water, and the multifarious necessary stores for fighting and keeping the sea, which limited to three months the length of sea cruises. These broad traits show the fighting type of navies formerly, an uniform type, the same for all maritime nations; so uniform, so constant, that to be able to estimate accurately the individual strength of each ship, it was sufficient to estimate accurately the height of her mast, and the distance between her two principal masts; consequently to estimate the actual force of a squadron, it was sufficient to count the number of units, the number of ships of the line, which composed it.

In the same way, as constant was the constitution of the *personnel* which belonged to these ships and imparted to them their life. Admirals, Officers, crew, all, before any other qualification, were obliged to be seamen, seafaring men. During peace, long sojourns at all points of the globe where commercial or political interests existed, voyages of circumnavigation or discovery, lastly, special evolutionary squadrons, were the practical schools where were trained Officers and men to a unique life, a special science. A unique life, where

isolation, solitude, inward reflection, study and work, moral and physical privations, formed characters; where habitude to difficulties vanquished, perils braved, dangers surmounted, imparted a valuable experience, that of constant uniformity of causes under variety of incidents, and made of the true seaman, the ideal stoical man of the poet, remaining unmoved before heaped-up ruin. A special science, whose conquests, whose progress travel slowly, by long transitions, and of themselves, betray, by some reform, by some improvement, insignificant in appearance, but most important really, in rigging, in sails, in gunnery, in stowage, in internal economy. In time of war, this experience of the sea so roughly acquired, these reforms so slowly accomplished, proved themselves to be of decisive importance; they were the recognized roads to victory between two fleets which were led to battle by chiefs on whom were imposed the same tactical rules—uniform, mathematical rules—from which only some few chiefs diverged, the Suffrens, the Nelsons, who were only absolved for having transgressed them by achieving the most glorious successes.

The long accounts of naval battles, and of the constant critical study of them, demonstrate the fixity of these rules, founded on a constant uniformity of causes, despite variety of incidents. For several hours, often during entire days, the weather gauge was manœuvred for. At last the two fleets join, both sailing in the formation prescribed by rule, line ahead or line of battle (*en ligne de file ou de bataille*), the two expressions are identical; they cannonade each other now at a distance, now yardarm to yardarm; their sides are pierced by repeated broadsides, the scuppers run with blood, spars fall from aloft and drag helplessly alongside; the helm, carried away, no longer directs the movements of the ship, almost motionless; boarding has become possible, for some it has decided the battle. The Admirals seek in the *débris* of their fleets how many ships can still manœuvre. The conqueror will be he who can count most of these; he can accomplish the destruction of his adversary if the latter persists in a heroic and mad resistance. But the wind shifts, night comes on, or some other incident puts him out of his reach, the battle is not ended; it is soon renewed on another field of battle; or night has not come on, the breeze has remained in the same quarter, nothing has altered the respective chances of the combatants, or perhaps even a gale has finished the work of destruction so well begun. Then the victory is decisive, call it Trafalgar if you like, and for ten years England will remain undisputed mistress of the seas. Her squadrons will blockade her enemy's coasts, be they those of Napoleon's empire, that is to say, those of Europe; her convoys will fearlessly traverse the great commercial routes of the world, upon which the merchants of Liverpool and London alone will trade and monopolize the wealth.

From the great naval wars of Louis XIV to the great naval wars of the Revolution and the Empire, the last which have stained the ocean with blood, these few lines sum up the long accounts of all naval battles. They also fix the positive results, sad or glorious for us, according as the French fleets are commanded by Duquesne, Tourville, Suffren, or the English by Rodney, Jervis, Collingwood, or Nelson, the last and most illustrious of all. Aboukir, more than Saint Jean d'Acre, destroyed the dreams of the illustrious conqueror of the Pyramids; Trafalgar ruined the projects of the glorious Emperor, and threw him back from the shores of Boulogne towards the battlefield of Austerlitz. The master of Europe exhausts France in a struggle whose issue will be fatal for her. The mistress of the seas, England, prepares in security behind her "wooden walls" her future of incomparable greatness, and extends the foundations of that immense empire with which to-day she encircles the world, that empire whose best provinces are colonies created by France—Canada, India, the Mauritius—where the names of Dupleix, of La Bourdonnais, of Montcalm, are the sole remains of what was once the expansive strength of our race.

Thus, the uniformity of the type of the ship of the line, the fighting unit; the uniformity in the composition of squadrons, *réunions*, more or less numerous, of these units; a single motive power, the wind, only allowing a limited number of tactical combinations and imposing them on the most adventurous minds; a single weapon, the gun, throwing similar projectiles: such were the constituent elements, almost identical in everything, of all sailing ships. Wherein lay the difference? In the men who manned these ships, the chiefs who commanded these squadrons, and who, in the supreme hour, animated them with the spirit of their heroic souls. "Cover my ship with white ensigns!" cried Suffren in the height of the *mêlée*. "England expects every one will do his duty!" was the order of the day flying from the masts of the "Victory," Nelson's ship. His duty was victory, and certainly the results of this victory when, as at Trafalgar, it crowned a long fight, were worth the floods of blood with which it was bought. It was for the conquered nation, the annihilation of its commerce, the loss of its colonies, the strict blockade of its coasts; it was, for the victorious nation, the empire of the sea, the trade of the world, the absorption of its wealth.

What are the navies of to-day, and in the existing state of things, what would be the probable consequences of a naval war? I open one of the numerous semi-official works, which give, with innumerable details, the composition of all the navies in the world. Commencing with the United States of America, which have no ironclad fleet, and ending with England, which relies for her safety to-day on her iron walls, as formerly she did on her wooden ones, and who, by that alone, remains the first naval Power in the world, the difference is immense; other navies remain in intermediate *échelon*, all more or less distant from the English navy in point of numbers, but all assimilating to her in their constituent elements. The variety of these elements is seen at a glance: masted fleet ironclads, fleet ironclads without masts, ironclads for foreign stations, ironclads with batteries, with citadels, with fixed turrets, with movable turrets, and I know not what else. A multitude of types varying according to the epoch in which they were conceived, and from which each, by that fact alone, only distantly resembles the preceding type, or the type which has succeeded it in the creation of the ironclad fleet. This is an inevitable consequence of a period of gestation, and production; accordingly, experiments, experiences, trials, *schools*—to avail myself of a vulgar but expressive term—and this period must have an end; one would like to believe it, but is it possible? Italy, the latest arrival in European nations, has wanted, like them, to have her navy, and after the battle of Lissa, she resolved to build it up in every way; further, as she only aspires, for the present at least, to influence over a limited portion of the maritime world, the Mediterranean basin, she has wisely avoided ironclads for foreign stations; she has thus been able, in building each part of her navy, to avoid trials, experiments, *schools*; and to concentrate all her resources on her fighting fleet, on her fleet ironclads. Their total number reaches eleven, and they divide into two broad categories: masted fleet ironclads, fleet ironclads without masts; of seven which form the first category, four, built at a period already distant (1863-65), are of a similar type and are sister ships. The fifth even is vastly different and is improved; while the two last, fitted out in 1875, only distantly resemble the previous constructions. However, theories seemed to have formulated by the lights of a long experience. The Italian engineers thought they had arrived at, if not the definite type of the true fleet ironclad, at least the assured type for some time to come. The "Duilio" and "Dandolo" were put on the stocks; they were not finished (1878) when a new type took the place of that which had only just been designed. The "Italia" and "Lepanto" will be the specimens of this new conception.

The example appears decisive; but this example would be furnished us, only perhaps with less definiteness, by every ironclad navy. Is it not the irre-

sistible proof that, by the incessant progress of the science relating to the sanguinary industry of naval war, this industry is fatally doomed to uncertainty and instability?

Should this problem be correct in its enunciation, which be the master, the strength developed by the attack or by the defence? The solution thought to have been discovered when iron replaced wooden walls, recedes every day from those who seek it. Iron has replaced wood, steel has replaced iron, rifled guns of 100 and 120 tons, have in a moment replaced Paixhan's howitzer, and the enormous American smooth-bores. The shock of the ram has replaced the shock of the overhanging bow. The Whitehead torpedo replaces the stationary torpedoes with which the Russians strewed the shores of Cronstadt in the old days of 1854. Rams, rams with hardened spurs, armed with one or two guns of the heaviest calibre, replace the floating batteries before which crumbled the walls of Kinburn, which the catastrophe of the "Arrogante" has for ever condemned, and to which to-day the Russians would oppose their circular Popoffkas; Thornycrofts, with a speed of eighteen to twenty miles an hour, formerly deemed impossible, replace the stiff and noisy torpedo boats of other times. Is this all, and these rapid transformations, if not progress, on the part of science, are they the last which science will force on us? Who can venture to say so? Henceforth no one can say that either the Italian "Lepanto," or the English "Invincible," or the French "Dévastation"—and these names are taken amongst many others—realize in the navies of to-day the looked for type of the fighting unit, of that unit which formed the old navies: the ship of the line. People affirm so and say, "Science, or at least its application to naval warfare, has its 'limits, in all reason.'" The time is near, if indeed it is not already come, when these limits will be reached. In fact, the wooden ironclads are nearly as good and as powerful as the future ones, both for attack and defence. By building them on a single type, after real experience, the problem will have been solved as far as it is possible; and what experience? That of war? *Fata viam invenient*. Till then, the real naval power of a country shows itself in its superior squadrons, that is to say, the *rèunion* in numbers, more or less numerous, of ironclads of the most recent type.

It is the fate of good ideas, that after a certain time of doubt and mistrust, they are adopted by all right-thinking minds. Have these ideas, which for thirty years have prevailed, and which have brought us to the state of affairs which we have endeavoured to sum up, this stamp of evidence? Are they adopted? Let us analyze them.

The first, fundamental, original point of departure, even the principal of the whole system, is this, the fighting ship is an ironclad; the second, the fleet ironclad must combine the maximum means of attack, and the maximum of resistance. The question of non-armouring has been for some time placed before the public, and by men whose real competence is denied by no one. It has been ignored: for what reasons? I search and can find none, for France at least, than the fear, perhaps legitimate, of being the first to assume the responsibility of such a radical measure. The "*Fata viam invenient*," this happy mean of doing nothing, this reason, the chief characteristic of so many characters in our age, has prevailed, and the fact exists as an official truth. The fighting ship is the fleet ironclad; let us acknowledge this with a single exception: the United States of America have not an ironclad fleet.

The second leading idea is that the fleet ironclad ought to combine the maximum of aggressive power with the maximum of resisting capabilities; this has led, in England, to structures such as the "Inflexible" and her class; in Italy to the "Italia" and "Lepanto." The principal points of this last type are: length between perpendiculars, 122 mètres; height above water-line, 7 mètres; draught, 8.50m; maximum speed, 17 knots; armament, four guns of 0.450m (100 tons), 18 of 0.17m; an armoured deck placed 1.80m at the

extremities and 1.05<sup>m</sup> in the centre below the water line; an upper battery with 0.450<sup>m</sup> plating. A ram, and, in the battery, torpedo carriages, complete its means of attack.

It is the ideal of its kind, the Italian ideal at least; but its rivals of other nationalities scarcely fall short of these enormous dimensions; their resisting capabilities are, as far as one can say, equal to hers, and like her, they combine the four elements of attack: guns, rams, torpedoes, and speed. Their cost comes to between 15 and 24 million francs, an economic fact which we shall take account of later on.

The first and not the least serious objection which we can make to such creations, or better still, to the theory which produces them, is the forgetfulness of the principle, at present, admitted uncontestedly, that in every industry the maximum useful effect is gained by division of work; here the ignoring of the principle is not due to forgetfulness, it is aimed at, it is sought after; is this more rational, is it more justifiable? The doubt is permissible, and most competent judges have raised objections, which carry considerable weight, against it. The fleet ironclad, such as engineers can produce under the conditions which are imposed on them, is it the most useful, the most effective fighting instrument; or else, would not this be a collective whole of diverse elements, thanks to which, the concentrated forces of a single ship—ram, guns, torpedoes, speed—would be able, at a psychological moment, so to develop themselves as to furnish the maximum of their power, that is to say, of their useful energy? In other words, and to put the problem with the greatest clearness and precision, a fleet ironclad fighting at the same time against a ram; against a ship armed with a gun of the heaviest calibre, for which it was simply a moving carriage; against four torpedo ships, all possessing and being able to develop in all phases of the encounter greater speed; would a fleet ironclad, we say, thus attacked, be able to resist the simultaneous attack of these adversaries?<sup>1</sup>

Without entering into a technical discussion as to what is the practical value of this new idea of the fighting unit in fleets, we would admit in its favour that it is upon the combined action of its parts, supported by the forts on shore when they exist, that the defence of our coasts and seaport towns rely. From the preceding, is not the first of our assertions, the point of departure for our researches, "that no one can formulate what is to-day the precise weapon in a naval war," fully justified?

Even from this incertitude, one may judge, *à priori*, of the vagueness of the new rules for naval tactics; but unhappily, or happily, even with fleets composed of *fleet ironclads*, this incertitude is recognized by all those who study this science: this is the result of their writings and even of the codes adopted by evolutionary squadrons of the chief naval nations. *It seems to be admitted* that an action will commence by a primary general attack, a collision between single opponents, ship to ship; the fleet being formed "in an order for which can be laid down no absolute rule, as an Admiral must always avail himself of the exigencies of the moment and subordinate the formation of his ships to the formation and order adopted by his adversary."<sup>2</sup>

It seems further to be admitted, by a theoretical fiction which is not borne out by experience, that if we bring to it calmness, *sans froid*, an indomitable will, this passage of arms will not produce any serious results,—*the vessels only having grazed past each other*,—and that the first phase of the fight will be followed "by a *mêlée* in which a fleet must divide itself into several groups of ships, each a fighting unit" attaching itself to a particular opponent. In this *mêlée*, what will ensure success? "A lucky chance, like that

<sup>1</sup> The question, in identical terms, is actually under discussion at the English Admiralty.

<sup>2</sup> De Penfentenyo, *Projet de Tactique Navale*.

" which, at Lissa, has immortalized the name of Tegethof," who, "like Nelson at Trafalgar, triumphed more by the energetic daring of the Captain than by the wise combinations of the tactician. . . ." We could multiply these extracts. What more explicit avowals are wanted, that fixed rules no longer guide naval tactics ; that this science, formerly almost rigid, "will not hereafter abandon its speculative character, and will not resemble those branches of human knowledge founded on accurate dogmas and fixed rules ?"<sup>2</sup>

Thus, variety in the type of the fighting unit, variety in the composition of fleets, a single motive power giving in the open sea a single ship power to go in any direction, but leaving indeterminate the rules of tactical combinations ; no longer one but three weapons, from any one of which a single blow can be fatal : such are the constitutive elements of existing navies. Wherein then lies their difference ? It lies in the individual power of each, and in the number of ironclads.

Such are the navies of to-day, assuming only as right the fundamental idea from which they all spring, that the fleet ironclad is the real fighting instrument. From this we can assert the following propositions which logically follow :—

- 1st. With individual equality of the constituent elements of two opposing fleets of ironclads, victory is certain for the more numerous of the two fleets, whose reserve will not engage until after the first phases of the fight, the collision and the beginning of the *mêlée*.
- 2nd. Action must then be ruled by the more numerous of the two fleets, the other being, all things otherwise equal, sure to be defeated and destroyed.
- 3rd. The respective forces, both in number and quality, of two navies being always known before the commencement of hostilities, the empire of the sea will belong without dispute to that one of two nations whose ironclad fleet is more numerous (Franco-German Navies, 1870 ; Russo-Turkish Navies, 1877).
- 4th. Great naval battles having for their object the empire of the sea, there will be no more pitched drawn battles.
- 5th. Naval warfare is extinct.

An absurd conclusion, but which proves that the premises of logical reasoning, which leads to it, are wrong, that is to say that—

- 1st. If the fleet ironclad opposed to any other ship is perhaps really superior to her adversary, she is not really the fighting unit of the sea, vainly sought after at present.
- 2nd. That a fleet, a *réunion* more or less numerous of fleet ironclads, is not the representation of naval power.

## II.

It is a long time now, since, in the first years of the century, Fulton, the real predecessor of the engineers of our day, discovered the secret of a submarine torpedo boat, and offered it successively to the French and English Governments. Both rejected his offers, but after appointing Commissions to examine and test the efficiency of this new instrument of war, and on the probable results of its adoption, its usefulness was recognized, and it was that which decided the refusal of both Governments, then, notwithstanding, engaged in an obstinate war. "We have the supremacy of the sea," said Lord St. Vincent, First Lord of the English Admiralty ; "is it for us to encourage the adoption of "an instrument of war which can wrest it from us ?" Pitt, the great Minister, added : "Such a system, if successful, could not fail to annihilate all

<sup>1</sup> Amiral Bourgois, *Théorie du Gouvernement*, 1863.

<sup>2</sup> Lieutenant Semeckin, A.D.C. to Admiral Boutakof, *Lecture sur la Tactique*.

"navies." As for the French Commission, they thus explained the conclusions arrived at in their report, as follows: "What will become of the navies of the future when, at any moment, a ship can be launched into space by a sub-marine boat, from which no human prevision can protect us?"

The Governments of our time have overcome these scruples, these considerations of the future. With a striking energy they have shown themselves full of emulation in a reverse direction, and believing doubtless that each new invention of this kind constitutes a progress, gives a fresh power to their country's navy, they have accepted and adopted every invention, the secret of which may have been offered them. Certainly to see the formidable war machines of which fleets are composed at present, to reflect on the sacrifice of money they require, to judge of them above all by the developments they exhibit, not only in the country which always assumed to exercise an influence on the sea, but also in those which never possessed a navy, it would seem as if the statesmen of the past were mistaken in their ideas; it seems as if facts themselves belied them. At the bottom, in reality, is it really thus; and which have best prejudged the future, they or the statesmen of to-day?

Nothing is true on this earth except relatively. The fleet ironclad is, with its steel armour, 100-ton guns, Hotchkiss guns, Whitehead torpedoes, gigantic ram, 16 knots speed, perhaps the most formidable engine of destruction which human science can produce; but ironclad fleets are not perhaps, we have seen, the most efficacious instruments of naval warfare, their *raison d'être*.

Who can say that England's security (the only point of view from which Pitt and St. Vincent regarded the question) does not inspire in their successors fears which the former never felt, even when the First Consul watched from high on the rocky shores of the British Channel the transformation of his army of Marengo into the army of debarkation, and hastened the organization of his Boulogne flotillas. Actually, recent modifications in the constitution of all navies have led in naval warfare, and above all in the results of this warfare, to profound changes, even those which these statesmen foresaw with a patriotic sagacity, which dictated their refusal to adopt the murderous invention of Fulton.

The supremacy, the empire of the sea (which none disputed with England after Aboukir and Trafalgar) still belong to her; we have shown, besides, they are acquired by the nation whose ironclad fleet is superior in number—and the English fleet has no rival—but if the words remain the same, how very different are the ideas which the words express.

The empire of the sea was then, for England, the safety of her merchant fleets; still more that of her coasts and seaports: sentinels always alert, watchful eyes constantly directed towards France, the frigates, advanced guards of blockading squadrons, followed every movement in our military ports and encircled them with an iron chain, which was only broken for a few moments by the weather forcing them to stand off. Should our cruisers have been able to profit by this fleeting and long awaited for hour, their destiny was written, their cruise soon ended in a heroic struggle, a grand demonstration of courage and patriotism against numbers, and our sailors peopled the hulks of Southampton and Plymouth. Towards the last years of the first Empire, the blockade of all the European shores was effectual; nothing passed through the chain of English cruisers except with their permission.

The cruizes of the "Alabama" and the Confederate cruisers; more recently still, in the South American War, the epic of the "Huascar," under the command of the heroic Admiral Grau, show what these blockades, heretofore so effective, have now become; they show what value the empire of the sea is for the protection of commerce, the security of the coasts of the nation which holds in its hands this worm-eaten, more than half destroyed,

sceptre ; they have at last put in a plain light the moral causes, or at least the economic ones, which, better than the direct blows of the enemy, strike at the heart, and ruin for long periods (if not for ever) trade itself.

"The Confederate privateer cruisers had not merely a material effect, the capture and destruction of American ships. Up to the month of May, 1864, 239 ships, of a total of 104,000 tons, of a value of more than 15,000,000 dollars (nearly 3½ millions sterling), had been destroyed. The moral effect had been still greater. The greater part of the Federal trading ships were transferred to English owners. In 1863 alone, the transfers of 348 ships, representing 250,000 tons, were registered. Insurance rates rose to an enormous price for Northern trade. The war was still prolonged, not merely by the resources brought by blockade runners, but also by the confidence inspired in the defenders of state rights by the constantly repeated exploits of Semmes, Wadell, and their imitators."

If this is so, is not a new phase put on future naval wars, and do they not appear to have, as before, their most effective instruments in very fast cruisers, to which, by their speed and the pluck of their Captains, the prestige of ubiquity will be given, enabling them to laugh at pursuit ? To assert that it will be thus would be perhaps to hasten it, in France above all, where ignorance of seafaring matters is only too general ; and since the really scientific method exacts that all hypotheses be verified and sanctioned by experience, let us see if there are not other more recent facts which will place beyond doubt the truth of what we have just seen.

The war of secession is over. The rebel States are conquered. They expiate their mistake or their crime. But have they not had their accomplices, and shall these accomplices remain unpunished ? More than one European Government have aided not only by their voice and sympathy, more or less acknowledged, but by acts, the long resistance of the Southern States. The most compromised amongst them is assuredly the English Government. It is in English ports that the Confederates have obtained the elements of their navy, and further, it is England who became heiress of the expiring commerce of the Northern States. Has she not to render a strict account of all her acts, of the facilities which Southern cruisers have found in her arsenals, of her easy interpretation of international laws, of her complacent and ready appreciation of the rights of rebels to be recognized as belligerents ? All these injuries will be massed together and will make a question of which the title alone will sum them up and show the alarming extent. It will be the "Alabama" question, and the "Alabama" question is decided. By it, two great maritime nations (the most powerful of all) are brought face to face : both animated, notwithstanding the passage of time, and the progress of modern ideas, by one of those intense family hatreds which best preserve the memory of injuries received and the bitter desire to avenge them. Of these two nations, one has an ironclad fleet incomparable in point of the number and strength of the vessels composing it ; she will surely be, she already is, the Queen of the Ocean ; wherever her fleets show themselves, they are sure of victory,—what am I saying ? they will meet no adversaries. The United States have not a single ironclad with high freeboard to oppose them.<sup>2</sup> What does it matter ? The question of the "Alabama" is decided.

<sup>1</sup> *Les Croiseurs, la Guerre de Course*, par M. Dislère, Ingénieur de la Marine.

<sup>2</sup> *Le Temps* of January 6 publishes in its correspondence the following note on the moral difficulties of the creation of an American War Navy:—"The creation of a war navy is, therefore, more than ever the dream of American statesmen, and there is no doubt that the task will very soon be undertaken. The principle has been accepted some time ; they are now studying a suitable system, and also the organization of ways and means. It is very natural that Mr.

How will it be solved? By war? No. The Geneva Congress settles it. Its decisions condemn England, and England submits, and religiously executes the arbitrary decisions of the Congress—decisions which bow her haughty patriotism to the feet of her former subjects, now become her proudest rivals; and now has not the reign of justice at last arrived? Will not right henceforth be no longer oppressed by might.

Those can believe it who are satisfied with words and illusions. Yes, without doubt, the English statesmen said well, that, in accepting the arbitration of the Congress, in executing its decisions, they only bowed to justice; it would appear that no one can say the contrary, notwithstanding that those who pretend to see to the bottom of things answer, No, justice alone has not triumphed. No, right has not overcome might. It is, on the contrary, might, and might alone, which has conquered; only, and by a concordance of circumstances too rare in this life, might was the auxiliary of right and justice. What is this force of which they talk, and on which side is it seen in a war between two adversaries so unequally armed? It is to be seen where it really is, on the side of the United States, who themselves have not adhered to the first article of the sentimental Declaration of 1856, and whose innumerable privateers are ready to enter into eager pursuit of the merchant fleets of England. English squadrons can furrow the ocean and carry their glorious colours to all points of the globe,—how many of their merchant ships will know of the dangers which menace them? And English trade destroyed, what becomes of English power—what becomes of England herself? A naval war of the future against England, at least, would very likely be essentially a cruising war. Let us proceed in our researches.

The war of 1870 came like a clap of thunder in an unclouded sky. The French ironclad fleets are ready. The evolutionary squadron covers the Mediterranean and secures the return to France of our African army. A second squadron has already cleared the Sound, and blockades the German coast from Kiel to Dantzig; lastly a third leaves Brest and threatens the shores of the North Sea, a recent acquisition of Prussia. The German ironclad division hastens towards Wilhelmshaven, and shuts itself up there,

“Arthur should look carefully before selecting the man to be charged with a mission of this importance; and this very laudable prudence is complicated by a delicate consideration: it is that, in the United States as elsewhere, the real Controller of the Navy has always been the ink-bottle. Arsenal and workshops have always been given up to pillage; hundreds of millions of dollars have been swallowed up without anything being left but some wretched carcasses of ships, not one of them fit to accept battle—and still less to refuse it, has said an Admiral. Everything then has to be created, *personnel* and *matériel*, and it will want a safe hand to make a clearance for the future improvements. But here, more than anywhere, is Mr. Arthur embarrassed in remaining independent of the public and his surroundings, without severing old friendships, for there are still traditions of such a time reigning in naval administration, and these are the most detestable traditions of a time when official corruption attained the highest limits of cynicism.”

And we extract from the *Army and Navy Gazette* of December, 1881, the following paragraph:—“The Commission is of opinion that an ironclad fleet ought to be built, but that there is no need to proceed with it until the following 38 unarmoured ships are finished; 5 steel rams of 2,000 tons; 5 torpedo-boats; 10 torpedo cruisers; 10 torpedo-boats for coast protection, and lastly the 8 cruisers already building. This programme will not be completed for eight years. The Americans do not appear in a hurry to possess an ironclad fleet. The striking dictum of one of their most distinguished Admirals, that with their present ships it would be harder to refuse than to accept combat, even with the certainty of being beaten, demonstrates the idea which has guided the Commission. She requires ships of great speed, able to refuse combat and to impose it at her own time.”

determined not to leave the shade of its incomplete, improvised, but insurmountable defences; as to some few men-of-war, scattered over the ocean to protect the commerce of the Northern Confederation, they relinquish a mission, to accomplish which they believe themselves unequal. At anchor in foreign roadways and covered by the laws of neutrality, they remain impassible to the defiance hurled at them. The ships which they ought to protect follow their example and remain confined to the harbour where the news of the war has arrived to surprise them. Those which traverse the hitherto peaceful ocean routes, now become full of perils for them, are the prey of our cruisers, an easy prey whose best and perhaps only protection was the singular instructions given to our Captains, at the opening of hostilities. But the dark hour has come for France. Reischaffen, Sedan, Metz have seen our armies swallowed up, as in an immense gulf. The struggle continues, still unequal, but not despaired of. Men come in throngs, but how can you make armies of them? Where are the arms, munitions, supplies of all kinds which are necessary for them? For a long time our arsenals have been empty, and national industry is very dilatory. Whence obtain them? where buy them? In England, in America, in every market of the world,—these markets remain open to us, our cruisers protect the highways which lead to them; our fleets blockade the enemy's ports; France, conquered on land, remains at least queen and mistress on the sea.

Suddenly, a strange rumour re-echoes like a cry of alarm. A German cruiser has evaded the surveillance of our squadrons; it is the "Augusta," one of the privateers built in France for the American rebels, bought not long since by Prussia; her speed is greater than that of any of the cruisers sent in pursuit of her; she has appeared for an instant before Rochefort and has captured a despatch boat; some hours afterwards she was at the mouth of the Gironde, and captured two merchant ships who already fancied themselves in harbour. Where will she be to-morrow? Doubtless on the main routes from New York to Havre or Bordeaux. On all sides mistrust exists; assurance freights, transport freights increase on the markets open to our efforts. But the spirit of Semmes, of Wadell, is not in the Captain of the "Augusta"; by an unlooked for return of fortune for France he takes his ship to Vigo to get coal. Two of our cruisers follow him there and anchor alongside him, to his cost; till the end of the war the "Augusta" will remain powerless. Who can tell what difficulties a more manly decision would have brought to the last movements of the national defence, such as would have animated the intrepid seamen who commanded the Secessionist privateers, "Florida" and "Alabama," whose examples will become lasting models. In the supreme crisis through which we passed then, in the years which followed, years of sorrowful reflection, when all thoughts were directed towards the Vosges, the "Augusta" incident was forgotten, its results unknown. The importance of the new rôle of cruisers in all naval wars seems only to have been understood by some few isolated thinkers; later incidents are not slow in bringing it fully forward.

War, but a war for some time foreseen, breaks out in the East between Turkey and Russia.

The Russian fleet is inferior in number to the Turkish; like the Germans not long ago at Kiel and Wilhelmshaven, the Russian ironclads shut themselves up in the inaccessible ports of Cronstadt and Nicolaïef—the Russian cruisers will bear alone the weight of the war, and what cruisers! Some converted mail-boats like the "Vesta," not even having a speed equal to that of the majority of Turkish ironclads. One knows what service they rendered their country, not in destroying the trade of Turkey—that trade is in the hands of neutrals—but as convoys of those torpedo boats (I do not say Thornycrofts) which kept the Turkish squadrons, during the whole war, on the alert, and gave them more than one murderous blow.

Up to this point, however, facts do not give us direct proof of what we seek : a marked evolution in English policy supplies us with it. England appears to wish once again to take up the cause of her former client (the "sick man") of Stamboul. Then the society of volunteer cruisers is formed at St. Petersburg and Moscow ; its agents are in the United States, where they buy swift cruisers, the nucleus of the new Russian navy ; the crews are ready, the Officers appointed, and the tendencies of the Government, of public opinion in America, seem little favourable to the respect of the laws of neutrality. The memories of the "Alabama" are still fresh ; England is at a standstill, giving fresh proof of her impotence ; from what dangers does she recoil ? From the menace of a cruising war, in which her trade will be the stakes. But the lesson will not be wasted ; against the improvised cruisers of her antagonists, she will henceforth oppose a whole fleet of cruisers, some, real men-of-war, built and armed for cruising, others, mail-boats of superior speed, built under special conditions, so as to be transformed into men-of-war, and which, when the moment arrives, will perhaps be the most effective elements in the defence of her commerce. The "Servia" is the last of the Cunard Company's mail-boats, built according to those ideas. She is 161 mètres long, 15·85<sup>m</sup> beam, stowage capacity of 5,500 tons, not including 1,800 tons of coal, and 1,000 tons of water ballast, her hull is steel, her speed 17½, perhaps 18 knots.

These powerful efforts of England are significant. Also, without recalling the exploits of the "Huascar," the adventurous cruises of the "Union," a sister ship to the "Augusta," on the coasts of the Pacific, from Callao to Punta Arenas Point, in the Straits of Magellan, it seems to us possible to assert that naval war of the future will be essentially a cruising war. Will it be only a cruising war ?

Frederick II of Prussia said, that to conquer, three things were necessary : "money, more money, and still more money." Danton, that three things were necessary : "daring, more daring, and still more daring." The great king, philosopher, and warrior, and the great revolutionist, supplement one another, or rather, their idea is the same. Only, Frederick knew he was rich enough in daring to give to those whom he inspired with his powerful will ; he did not say anything, but he preached by example.

More than ever now, money and daring are the first elements of victory, especially in a naval war, when money and daring are placed at the service of science and experience.

One knows what is the cost of the ironclads of the fleet : money has not been spared in making the most powerful weapons of war. Nevertheless, and perhaps by their very existence, will they not respond, in the decisive moment, to the legitimate hopes which have inspired European Governments, and decided them to launch into this costly war of innovations without end and perhaps without issue ?

A fleet superior in numbers will be, from the commencement of hostilities, mistress of the seas. But to-day this sovereignty is a word more than a fact ; it does not even guarantee the security of the national trade ; is it therefore for this meagre result that these fleets have been built, and, war coming, will they not have a rôle to play, missions to fulfil more worthy of the great forces which each ship carries in herself, and of which their massing seems bound to still more increase the power ? These missions, this rôle, all point to one condition, however : it is that, descending from the elevated clouds of this sentimentality, which has created this monstrous association of words the rights of war, we come back to the logic which in reality leads the world, and whose law people and individuals always repent not having known.

War may be defined, the supreme appeal of right, against the might which denies that right. What is the chief object of war ? To inflict the greatest possible harm on the enemy. But if a great king, a philosopher and master

in the art of war, declares that riches are the sinews of war, everything that attacks the enemy in his wealth, *à fortiori*, everything that attacks him in the sources of this wealth, becomes not only legitimate, but renders itself obligatory. We must then expect to see the ironclad fleets, mistresses of the sea, turn their powers of attack and destruction, in default of adversaries hiding from their blows, against all the coast towns, fortified or not, pacific or warlike—burn, ruin, and at least raze them to the ground without mercy. This is what has been done in other times; it is not done now; it will be done in future. Strasbourg and Peronne guarantee it.

By this new rôle and these new missions, which logic imposes on ironclad squadrons, we enter into a new system of naval warfare: that of the attack and defence of coasts. Whatever may be the object of the assailant, it is evident that he will come to it with every means of action which circumstances will allow him to unite, and which will be calculated with a view to the special object to be obtained. As to the defence, it seems bound to be divided into two distinct elements: stationary defence, movable defence: one comprising stationary torpedoes, booms, fortifications of every kind, placed beforehand or extemporized on the coast; the other, relying on the action, isolated or combined, of rams, floating batteries, gunboats, swift Thornycroft torpedo boats, supported, according to circumstances, by the ironclad ships, and emerging from the inaction to which the inferiority of numbers condemns them on the high seas.

The extent of the theatre of operations in such a war, the infinite variety of combinations which it allows, throws us once more back into the unknown, or at least the undefined. With the extreme mobility which steam gives to all men-of-war, whatever may be the special weapon with which they are armed; with the rapidity and assuredness of information which the electric telegraph permits; with the power of concentration which railways ensure; if, on the one hand, no part of the coast is sheltered from attack, on the other, there is no part which cannot be forcibly and rapidly protected. All attempts at debarkation, under fire, of a fleet mistress of the seas, seem capable of success, but every army corps thus venturing into the enemy's country seems bound to be repulsed again to the sea, before having firmly established its base of operations and supply of provisions and ammunition; and if this base relies on the fleet which has brought it, if it is by the sea that it must exist, its situation would appear to be venturesome, without any exception. Lastly, it is to be asked what weight in our days, for real success in war, is an army corps whose total effective force is not more than 30,000 men. Everything then remains, we again repeat, doomed to the unknown, the undefined, to lucky chances. This will be the business of those who will undertake such operations, after having decided on them; above all of those who will have to carry them on to a successful issue.

These reserves made, and we do not know how to insist too forcibly on their importance, it seems that from the obscure depths of this undefined, some few conjectures, having a certain amount of probability, if not certainty, detach themselves naturally. As these are the sole lights which result from our researches, and which permit us to push them further, we will try to resume them under the form of propositions:

1. The depreciation of the power of artillery against a movable ironclad target has been verified by experience. It sensibly lessons the risks which an ironclad fleet runs, covered with smoke and defiling at high speed before the most powerfully armed coast batteries. It is reasonable to believe that under many circumstances a fleet under the orders of a Nelson or a Farragut would not hesitate to run these risks, if the object to be attained was worth venturing such a stake.

2. Every fleet surprised at anchor by a fleet under steam is a fleet destroyed,

the ram, which the assailant alone can avail himself of, then becoming an arm as safe for him as it is destructive to his adversary.

3. Every fleet at anchor, if the access to the anchorage is possible, can be surprised by night or even attacked by day, by a fleet of Thornycrofts.

4. The range of guns of 0·27<sup>m</sup> being 11,000 mètres, that of 0·14<sup>m</sup> 7,200 metres, with an angle of training of 35°, every town, every settlement, occupying a large extent of ground, and which any ships thus armed could approach within a less distance than these ranges, can be bombarded, burnt, without the assailant running any serious risks from the coast batteries defending the town.

Some facts can serve, not to demonstrate, but to illustrate these propositions, which will remain doubtful until the time of practical experience. In all operations of war on which they bear, what is really the factor of success? Pluck, that is to say, contempt of death, placed at the service of patriotism and professional science. That is a moral force which succumbs not to any *à priori* suggestion. Turenne might well say on the eve of a battle; "Thou tremblest, carcass! thou mightest well tremble if thou knewest where I will lead you to-morrow." And the morrow he went where he had determined to go. The Captains who will make preparations for future operations of naval wars will doubtless tremble on their eve like the illustrious Marshal. Will they proceed to the end on the morrow? God alone can say.

The action between the "Huascar" and the English "Shah" and "Amethyst" furnishes us with the first of these illustrations. "The state of the 'Huascar' after the fight," says a military writer, "is an example of the depreciation which naval artillery undergoes on the day of action. The results obtained in actual battle are far removed from those observed at the proof butts. . . . On the whole, the 'Monitor' has been struck by seventy or eighty projectiles. No. 0·23<sup>m</sup> projectile has perforated her armour."<sup>1</sup>

Toulon roadstead has just been hermetically closed by jetties to shelter fleets at anchor in these roads from surprise. Here are some of the considerations by which Rear-Admiral Du Pin de Saint-André justifies this costly precaution. " . . . It is possible that our fleet may have just arrived at Toulon after a laborious cruise; the crews are worn out, and have need of rest, not less indispensable to the engines and boilers; the provisions have to be completed, and the defects which require making good are urgent; perhaps a fleet of transports are assembled here in order to strike a heavy blow on an enemy's port, &c. Every case is possible. Will it be necessary to paralyze a flotilla of cruisers in order to watch the shores of the roadstead both far and near? Can you be certain that some lucky chance or act of the enemy will not disperse them? Are you going to keep the garrisons of the forts and batteries, and the crews of the ships on their feet all night to avoid all chance of danger? Whatever you may do, fate can some day accumulate in favour of the enemy all the (for him happy and for us unfavourable) chances, so that all your precautions would be useless. History exists to prove to us that the fortune of war marvellously agrees with the incredible, and that nothing is impossible.

"One day, at sunset, in clear weather, as far as the eye can reach from the elevation of the signal stations, and mastheads of the leading cruisers, no indication of smoke reveals the enemy. Accordingly, the enemy is afar off, he is 50, 80, 100 kilomètres away, if you like, at a distance where his presence cannot be suspected.

"However, the weather has changed; scarcely has the sun gone down when night comes on, dark and rainy, but the sea is calm. The enemy's fleet, stoking up and going full speed, steers for Toulon. Three hours suffice them

<sup>1</sup> *Revue Maritime*, 1881. *Des Operations de Guerre Maritime récentes.*

"to cover a distance of 60 kilomètres and more ; they have been able to escape the outer chain of cruisers ; they stop before the coast cruisers can see them. Immediately each ship, carrying a torpedo boat each side, hoists them out : these torpedo boats are armed, some with Whitehead, others with spar torpedoes. They leave and glide like serpents towards the entrance of the roadstead. Perhaps it will be answered that some of them will not succeed, but can one sleep calmly on this certainty? Well, in a roadstead, in a harbour, in an arsenal like Toulon, it is necessary to be able to sleep calmly at the risk of seeing the crews and troops exhausted by fatigue, the *matériel* promptly ruined, and all work stopped."

What is manifestly true for Toulon, is equally so for Cherbourg, and does not seem incredible even for Brest, although the competent writer whom we have just quoted adds : "An enemy's fleet could never arrive suddenly before Brest in the middle of the night. . . . To get there, they have first to surmount the difficulties of an intricate navigation, which allows the development of a formidable defence, and which renders certain sufficient previous warning. It is not on a dark night that an enemy could venture at full speed in the Iroise, and pass through the narrow entrance to Brest ; to do that, it is necessary to be able to see clearly, and to advance prudently, not to suffer shipwreck during this long passage. Within range of shore the artillery combined with that of fixed or movable torpedoes of all kinds will be fatal for them, and in every case, from the moment when the look-out at Ushant, the advanced sentinel, shall have signalled their arrival, to the moment when they shall have entered the roadstead, we shall have had all that time to prepare for their reception."

Everything happens, nothing is impossible, said the noted author we have cited, and I agree with this opinion. As to the facts on which his new optimism rests, they are perhaps established, if they only concern a sea-going fleet ; what becomes of them, if the passes are surprised, and later the fleets at the anchorage, by a flotilla of fast Thornycrofts, who would certainly need no pilot, whose presence will not be signalled by the look-out at Ushant, cut off by the enemy from the beginning of the war, if she is mistress of the sea? A question of pluck, resolution, of coolness and professional skill.

Besides, what does it matter, the thing is humanly possible, and in a harbour, in a roadstead, in an arsenal like Brest, as well as at Toulon, "it is necessary to be able to sleep calmly at the risk of seeing the crews and troops exhausted by fatigue, the *matériel* promptly ruined, and all work stopped." Illustration and not demonstration, we have said, and assuredly we do not imagine that we have dissipated the doubts which the problems we have agitated will have raised, new examples would be useless. But these doubts, this uncertainty, were they not the point of departure for our investigations, the *Quod erat demonstrandum*? Have these investigations then no positive results, no practical direction, no lessons by which we ought to profit? We believe, on the contrary, that in showing us what no longer exists, what cannot be, they have led us to what ought to be, that in telling us of the possible dangers of a false security, they enable us to exorcise them.

The empire of the sea, in the strict meaning which we must give to these words in the present day, belongs to the most numerous ironclad fleet. A maritime nation must then know against whom she has to maintain this sovereignty, and have an armoured fleet as numerous as that of her future adversaries. For instance : England, who wishes to maintain against all comers her naval superiority, and who, consequently, maintains her ironclad fleet in a state to fight with those of the whole world against her. This rule will last until the fleet ironclad is proved not to be the most effective unit.

<sup>1</sup> Amiral Du Pin de Saint-André, *La Rade de Toulon et sa Défense*. Paris, Berger-Levrault.

Cruizing will be the most efficient means of ruining the enemy's trade. It is therefore necessary to build a fleet of special cruisers. We have seen Russia wanting it, England who has built it with a resolution, and by exceptional measures, which ought to serve as an example.

The blockade of the whole coast of a country is impossible; that of a single port is extremely difficult; it is only effective by the concentration of numerous blockading squadrons, écheloned on several concentric lines radiating from this port. It is then necessary to distribute over several fitting-out centres the points of departure of our naval divisions and cruisers to assure their escape into the open sea.

Every point on the coast can become the place of debarkation for an enemy's army; every town on the coast can be burnt and pillaged by the hostile fleets, or even by simple cruisers. It is necessary then to distribute over several centres of action the different constituent naval elements for the defence of the coasts: raans, floating batteries, gunboats, and Thornycrofts; it is necessary then, as much as possible, to place these centres of action beyond the ranges of guns of greatest calibre, and prevent, by their number and their distance inland, the enemy knowing what is going on.

In order that our squadrons may anchor in our ports and roadsteads, preparing for sea, or that they may put in to fill up with provisions, or to refit after a cruise or an action, it is always necessary that our ports, accessible to themselves, may shelter them from an attack by main force and from surprise, and for this it is necessary that their access may be completely closed to the enemy.

Without pushing these conclusions of our researches too far, whilst admitting that they may not be perfectly true, is it not evident that they contain a grain of truth, that none can gainsay? In every case they are necessary to solve, in an efficient manner, the first questions that we set ourselves: Is it necessary in the interests of the French Navy to maintain, or to abolish, the military port of Rochefort? The necessary premises are placed before us, perhaps even at too great length; it is time to enter into the heart of the question.

### III.

The naval ports of Germany are Kiel and Wilhelmshaven. We extract their description from a remarkable work by M. Paul Meruau, published in the *Revue des Deux Mondes* six years ago.<sup>1</sup> "The Bay of Kiel is surrounded " by high hills, which shelter it from the wind. This belt of heights form " a wall round the basin of the bay which enjoys thus a security which is " further augmented by a curtain of woods growing on the hills. The " Fiord of Kiel is 16 kilomètres long; opening to the north, it is funnel- " shaped to the southward; the town of Kiel is at the bottom. Very wide " at the entrance, the fiord becomes very narrow; at one place it is com- " pressed between two headlands facing each other on either side. It is " there that, in 1870, a triple barrier was constructed composed of chains of " lighters laden with stones, and of torpedoes. There is there a fortress— " Friederichshort—on the headland, to the right of the entrance to the bay; " to the left, on the other side, the headland is guarded by a redoubt, armed " with heavy artillery; between the citadel and the redoubt the narrows are " not more than from 700 to 800 mètres wide, and to destroy the barrier " that would be re-established there in time of war, it would be necessary to " work under the cross-fire of these two extremely well-armed defensive " works. The squadron which should attempt this desperate enterprise would, " in any case, be obliged to silence the fire of other defensive works, which " precede Friederichshort, and are situated at the entrance to the bay; one at a

<sup>1</sup> *La Création de la Flotte Prussienne.* (Voyez *La Revue des Deux Mondes*, du 1<sup>er</sup> Mai, 1876.)

" place called Brauneberg, and opposite, on the other side, a redoubt with  
 " armoured parapets. This quadrilateral opposes more than 200 embrasures to  
 " an enemy. Nevertheless the general staff at Berlin does not find this system  
 " of defence quite sufficient, and is preparing its augmentation, by the con-  
 " struction of three other forts. Other precautions have been taken. The  
 " shores of the fiord possess, between the sea and the foot of the hills, a space  
 " of ground where the builders could have placed ships' timber stores, docks,  
 " and all the workshops which belong to a great naval establishment ; but for  
 " *greater safety, the arsenal and the port have been concentrated* in a basin dug  
 " out of the interior of the fiord, on the eastern side, near a fishing village  
 " called Ellerberck.

" Six defensive works are specially reserved to defend this basin and the  
 " establishments which surround it. Finally, the fortress of Rendsbourg,  
 " taken from the Danes, and situated in the neighbourhood, could at need help  
 " a fleet anchored in the port, and bring invading forces between two fires.  
 " As it is, the port of Kiel, such as it now exists, with a magnificent roadstead,  
 " a basin of 40 feet of water, where ships can everywhere come alongside,  
 " where there are neither currents nor undertow, where nature has, so to speak,  
 " prepared the emplacements for formidable fortifications, Kiel has in nothing  
 " to envy the finest maritime establishments ; its defence has been regulated  
 " by a Commission presided over by Prince Von Moltke in person, it is from  
 " this moment impregnable.

" The Government of Berlin has thought right, besides, to provide itself  
 " with a fortified port in the North Sea, facing England. . . .

" There was in the North Sea a place suitable to the formation of such a  
 " port ; it was the Duchy of Oldenbourg, whose territory commenced at the  
 " Weser and ended at Holland. Prussia, being in a hurry to build the port,  
 " bought, in 1853, from the Grand Duke, for 1,875,000 francs, a piece of  
 " ground of 310 hectares, at the mouth of the Jahde, a river flowing into the  
 " North Sea to the west of the Weser. The Jahde flows into a bay whose  
 " depth and extent are far from being comparable to the fiord of Kiel, but  
 " where works of considerable importance would permit the foundation of  
 " a military port. By a curious coincidence, the Government of Berlin chose  
 " this place, and the choice was made following the advice of Napoleon I, who  
 " had pointed out the bay of Jahde as a fit spot for the construction of a great  
 " military port at the time when the department of the Bouches-du-Weser  
 " was included in the French Empire. The works were undertaken without  
 " delay ; the enterprise was difficult of accomplishment, the ground in this  
 " spot is flat, sterile, and composed of a sandy clay ; it crumbles before the  
 " action of the sea. To give the banks the necessary stability it was necessary  
 " to stay it with dykes. This first work, often delayed by inundation, was  
 " tedious, long, and costly ; but the tenacious genius of the nation triumphed  
 " over the feebleness of the earth, and the opposition of the sea. The  
 " engineers went on without loss of time to the construction of the port.  
 " The tide running very strong there they placed immense locks to keep  
 " the water in the basins. *After passing through an outer harbour, enclosed*  
 " *by two granite jetties terminating in two moles, ships coming in pass through*  
 " *a lock into the interior harbour ; a second lock admits them into a canal, and*  
 " *this canal leads to the port.* This consists of a basin 1,100 feet long and  
 " 700 feet wide ; at the end are placed the building slips, dry docks, and  
 " workshops.

" The water in the basins is kept to the depth of 9 mètres, and the docks  
 " are capable of receiving the largest ships. The port of Jahde, therefore, can  
 " build and shelter a fleet of the first order. The fortifications of this arsenal  
 " are being completed with feverish anxiety. On the northern dyke three forts  
 " will defend the entrance ; at the other extremity of the bay, a place called  
 " Echwarder-Horn is being fortified." Let us add that in 1870 Wilhelmshaven

was not attacked by our squadrons, doubtless because it was not attackable. In any case, to-day one can say of the port of Wilhelmshaven, as of Kiel, that it is impregnable, from the sea at least.

Such are the two naval ports of Germany. Nature has done everything for Kiel: science and human will for Wilhelmshaven. It is because this will, this energetic perseverance, this science, surmounting all obstacles, should be a lesson to those who prepare the future of a great nation, desirous of becoming a great maritime Power, that we have literally transcribed this description of the two great arsenals of the German Navy, itself a recent creation of an energetic and persevering will.

We shall be more brief for the future.

Russia has two great military ports, Cronstadt and Nicolaïef. Nicolaïef is the southern port in the Black Sea; it is situated where the Ingul flows into the Bug, 25 miles from the mouth of the latter, which itself flows through the Delta of the Dnieper, and is 40 miles from Kinburn, the most advanced of the fortresses which defend its approaches. A glance at the chart will show the difficulties surrounding the navigation through winding passes, narrow and of a variable character, which lead from Kinburn to Nicolaïef. Ordinary stationary torpedoes would suffice to render them secure, and it is not on them alone that the defenders of Nicolaïef rely. Without enumerating all its defences, one can say that this arsenal is impregnable; equally secure from a surprise as from a distant bombardment.

Cronstadt is the great Russian port of the Baltic, the gateway of the Neva, the fortress of St. Petersburg, which it renders unassailable from seaward. It is an immense citadel which commands, by the converging fire of its 3,000 pieces of artillery, the channel which leads from the open sea to the inner roadstead and the mouth of the Neva. This channel is long and narrow; two ships cannot sail up it together; buoys, which in case of need would be at once removed by the defenders, mark the shallows through which it is cut. Cronstadt is impregnable, and if its distant bombardment is possible, the granite walls of its ramparts are now covered with steel armour-plating, and crowned by revolving turrets containing most powerful artillery. The enemy's shells would break against them perfectly impotent.

England, moreover, has four great naval ports: she seems to regard them rather as a protest against the pretensions and the monopoly of the powerful mercantile firms which construct her fleets, than as their building places. They are principally ports for fitting out and for repairs. Chatham alone is an exception. Latterly, it has developed to such an extent that it may be designated as the principal centre of concentration and of action for the British naval forces. Those words of a celebrated diplomatist, "*Tout arrive*," has doubtless inspired the statesmen of England. Everything does happen, and everything must be provided for, even the day when the iron walls will prove themselves less powerful than the old wooden walls, and will no longer ensure to England the indispensable empire of the seas; even the day may come when its coasts will be insulted, and its ports burnt by a victorious hostile fleet. That day Chatham will not be attacked, it is unattackable; sheltered from the surprises of torpedo boats, as well as from the attacks of the most powerful squadrons, its geographical position has rendered it so.

The arsenal at Chatham is situated on the right bank of the Medway, a tributary of the Thames, 20 kilometres from their joining point, or rather from the mouth of the Medway, as the Thames, at this point, is really the sea. The Medway's sinuous course, obstructed by shoals which narrow the channels open to large ships, has a mean width of 400 metres, but at more than five miles from Chatham the distance between the two shores is not more than 300 metres.

Kiel and Wilhelmshaven, Cronstadt and Nicolaïef, Chatham and the rest,

such are the naval ports, really creations of these latter days, upon which rely the three great European Powers of which it may be said that they hold in their hands the destinies of the world.

Whatever may be the conjectures that may be made, the fears or the apprehensions which recent scientific discoveries may inspire, together with their application to the art of maritime warfare, three at least of these ports seem to be destined to remain as they are at present, that is to say, to be able to defy any surprise, to successfully resist any open attack : these are the ports of Wilhelmshaven, Nicolaïef, and Chatham,—all these are inaccessible to the most rapid and subtle torpedo boats, and their distance from the sea shelters them from bombardment.

Do our naval ports fulfil these two conditions of inviolable security ? They do not.

Cherbourg, open to all surprises, is a nest for bombs and shells ; the glare of the conflagration of Sweaborg has shed, since 1854, a lurid light on the fate awaiting it in the next maritime war. The exterior channels and the *goulet* of Brest could be traversed in a few hours of darkness by torpedo boats, in a few hours of daylight by a fleet, defying, perhaps with impunity, the fortifications defending them. Lorient, whose inner anchorage is secure against any surprise, can be set on fire from the offing and destroyed in a few hours. Rochefort, whose inner harbour is protected against any assault by its distance from the sea, and the winding and narrow course of the Charente, is neither accessible to our squadron ironclads nor to our large cruisers. Toulon, which is now sheltered from the attack of torpedo boats by recently built jetties, is still exposed to a too easy bombardment. Such is, in a few words, the exact condition of our naval ports, such the conditions brought about by actual changes in the constitution of the navies of the present, changes which, by a singular state of things, a French Government has been most energetic in promoting. All word-splitting tending to propagate ideas once true, but now absolutely incorrect, all the sophistry of national vanity, all the paradoxes concealing irresolution, not to say incapability,—all these, we say, will not modify the situation in the slightest. There lies the truth, the whole truth, and that truth which presents itself, “with all its “patriotic agonies,” to those who still believe in France, who are still anxious about its destinies, and for whom have not been lost the dark lessons of “the “terrible year.” This truth Europe knows, but France does not. Who will teach it to her, and when ? To-morrow, perhaps, it will be too late. The Nile and Trafalgar preceded Waterloo : will Sedan and Metz precede the fatal hour when the naval power of our country shall sink for ever in a nameless abyss ?

But is there a remedy for this situation, and if this remedy exists, what is it ? Can Cherbourg and Toulon be protected from a bombardment ? No. Can Brest be protected from an attack by main force ? It cannot. Can it be protected from a night surprise ? It can. The present Minister of Marine, with patriotic intelligence, has, with an energetic will, undertaken the necessary works. Can Rochefort be rendered accessible to all our ships of war ? It can, and by less costly works, with more certain results, than those which can and should be undertaken for the defence of Cherbourg, of Lorient, and Toulon. But if this is the case, why have these works not been decided upon, or rather why are they not being executed ? Why have they not been finished long ago ? If everything that we have stated so far is false, such an indifference is inexplicable, it is natural, it goes without saying ; would that it were so ! Unhappily, others besides us see the future as we do, others have the same doubts, the same apprehensions, inspired by the false security which misleads the country. In secret official documents, in published papers, they have shown the new powers, and the new lines of action, of modern fleets, such as we have attempted to point out. They have indicated the dangers of our situation as we have done, they have pointed out the same means to avoid the

imminent perils as we have ; finally, they have faithfully reported the expressions of surprise, extracted from the sailors of Germany, of Russia, and England, not by a justifiable indifference, but by a wilful disregard of the truth.

As these writers had the authority of science as well as of experience at their back, together with a high rank amongst the senior ranks of our navy ; if, we say, their advice seems to have been rejected, if the clear and precise results have not been adopted, if, on the contrary, Rochefort, *which they wished to make the Wilhelmshaven, the Nicolaief, the Chatham of France*, seems condemned as a naval port, even under the humble conditions of existence left to it by all the Ministers of Marine since Colbert and his great successors ; if this be the case, we repeat, we see and can see but one reason, not for this indifference, nor for this blindness, but for this voluntary effacement. The reason is that Cherbourg and Lorient—without any real value, abandoned to the fatality of the facts, which have condemned them with Rochefort, improvable as it is—are now useless to our naval power, for which Brest and Toulon will be sufficient for the future. To concentrate all our forces, all our means of action, on the ocean at Brest, in the Mediterranean at Toulon, or any other better chosen spot—the inlet of Berre—there to prepare, in secret, powerful squadrons whose junction, perfectly certain in these days, would render naval superiority secure, and enable a decisive blow to be struck against an enemy conquered beforehand, this is certainly a grand conception. It was, before Trafalgar, the conception of Emperor Napoleon to strike England to the heart with his army at Boulogne ; one knows what intellectual and physical causes frustrated these combinations of genius on the eve of their success ; nevertheless, to-day, is not this grand conception a chimerical idea, which the present state of things renders impossible ? The times are very far from us when the Emperor could write to his Minister of Marine, “ This is the *chef d'œuvre* of the flotilla ; it costs money, “ *but we only require to be masters of the sea for six hours for England to cease to exist* ” ; these times are far from us, less in years than by changes, and in the way of carrying out and in the results of a maritime war, crowned by the success of a great victory. These results we have tried to make clear, to show their real tendency. Let us admit that we are wrong ! let us admit that the meeting, at a given spot and at a given time, of all our naval forces, should be necessary to the success of a combination decisive in its result, will not this result itself be rather aided than baffled by the existence of several, or say even two, ports on the Atlantic ? The successes of Admiral Missiessy, the lucky chances which favoured him during his cruises among the Antilles, the rapidity of his movement there to deceive Nelson, were as fatal to the accomplishment of the Emperor's plan as were the storms which kept Admiral Gautheau, and the indecision of Admiral Villeneuve after the battle of Cape Finisterre, and his retreat to Ferrol. Their three squadrons, separated by so many different causes, could to-day, thanks to steam and the electric telegraph, meet each other at a given hour at the rendezvous pointed out to them at the last moment ; they would only need to escape the vigilance of the blockading squadron, an easy thing in these days, or, better still, to force their way out by main force.

We have shown the difficulties attending the effective blockade by ironclad squadrons. Everything that would diminish the strength, that is to say, the number of the fighting units of these squadrons would count towards the success of the two solutions : to evade or to break through the blockader. Now the number of these squadron ironclads being limited, and known at the commencement of hostilities, an addition to this number besides being impossible during the war (the time taken for the constructing and fitting out of a fleet ironclad being considerably more than the duration of a modern war), it is clear that the detailing of these ironclads into a larger number of blockading squadrons

would act, as directly as possible, towards the weakening of each of these divisions; but if these same squadrons, already reduced in number, should find opposed to them, not only the enemy's ironclads, whose actual numbers would be known, but other adversaries equally formidable, and whose numbers could be increased to any amount, is it not evident that the egress of our squadrons would become an operation whose success would be certain?

What are then these auxiliaries which would be called upon to perform a part so unexpected and so important? They are those rams, those gunboats, those torpedo boats—in fact, that “mosquito fleet,” as it used to be called, whose powers on the high seas may possibly be questioned, but whose efficiency in smooth waters becomes daily more apparent. Behind the line of skirmishers, who cover the position and hold the enemy at bay, the compact battalions manœuvre and execute the movement which decides the fate of the day; so also behind the threatening line of these maritime skirmishers in the face of the blockading squadron, driven back to the offing, our fleet ironclads will pass out, and the sea will be opened to them.

The principle of the division of labour, producing the maximum of useful effect, finds here a new and fertile application, but this application condemns the concentration of our fleet ironclads, within two isolated ports, one in the Mediterranean, and the other on the shores of the Atlantic.

We have established, in speaking of defensive warfare for the protection of our coast, the necessity of multiplying the centres of action, from whence would issue along the shores, to defend the points that would be attacked, the numerous elements of this war, namely, rams, floating batteries, gunboats, and torpedo boats; if they must be required to help to free our ports from blockading squadrons, must not these ports, starting points and places for the refitting of our ironclads, whose junction with the squadron they form part of is mathematically certain, should not, we say, these ports be as numerous as possible? Thus, let one admit or reject our ideas, on the manner of carrying out what our fathers called “The Great War,” and its results, reason leads to the multiplication of the centres of building, fitting out and despatch of the instruments (whatever they may be) of naval warfare, which will be a war of conflicting squadrons, a war between cruisers, and a war of coast defence. Thus, also, the making of Rochefort a real military port, that is to say, a port inaccessible to the enemy, and always open to our ships and squadrons, appears of itself essential. Considerations of another kind, but not less serious, support this idea.

Any squadron, taken by surprise when at anchor, is, as we have said, lost; *à fortiori*, any squadron, any solitary ship, whose motive power would be seriously affected, would be at sea a squadron or a ship lost. Now, after one of those naval battles which one presumes to be necessary, where the victory has been hotly disputed, all the survivors, conquerors or conquered, will issue from the fight seriously damaged; the greater portion of them will be but floating wrecks, which their comrades will convey to a friendly shore. One can imagine with what efforts it will be done, and through what difficulties they must hasten; nevertheless it is not the tempest alone that would finish the work of destruction so well begun.

Has not some swift cruiser borne the news of the battle to the nearest port, and will it not return, leading fresh adversaries, eager to complete the conquest, or still more eager to turn the defeat into a victory? A day, an hour even, would be of vital importance; a scrap of canvas spread to a favouring breeze, ocean currents leading to a port of refuge, these might decide the fate of those formidable warlike machines, which cost a million of money, and three long years' labour to complete.

On this vast battle-field, so often stained by rivers of blood, comprised between the coasts of Spain and of France, between Finisterre and the Lizard, wherever may be the spot chosen for the fight, prevailing winds and constant

currents all lead to the coasts of Gascony. This is a fact which can be ascertained, with reference to the currents, by consulting the simplest of atlases or maps, Stieler's No. 7 for instance; and as to the winds, by the laws of gyration for our hemisphere, during the entire year, winds between south-west and north-west are the prevailing ones, and blow the longest. These winds and currents, therefore, will urge, with more or less power, these floating remnants – glorious *débris* of battle, towards the French coast, south of Ushant and of the entrance to Brest. It is their principal chance of safety; but will it be so, will they be saved? To ensure this a port must be opened to them, where the enemy cannot touch them. From Brest to Bayonne such a port does not exist: it must be made. Where? At Rochefort, where it is alone possible. The task we have laid before ourselves is nearly finished; it is not our duty to show here, we will not say the possibility, but the extreme facility of digging an open canal 9 mètres deep, and not more than 20 kilomètres long, either from Rochefort to the Fosse d'Enet, or from Rochefort or Soubise to the roadstead to Estrées on the left bank of the Charente.

The preliminary designs have been executed, and well executed, the plans have been prepared, and it is not the estimated sum which has stopped the completion of the works. What is this sum in comparison to those which have been spent on Cronstadt, on Wilhelmshaven, or on Chatham? No, what has stopped the execution of these works are those ideas which logic itself has forced us to refute, and which it has seemed to be our duty to dispute.

It may be that we have not succeeded: we fear so. What matter? others will succeed. The hour of truth, as that of justice, is slow to come, but it always does come. Anyhow, our work will not be useless; whatever happens, we think we have placed beyond controversy the two points which have been our starting points, and the base of our researches, namely, no one can say what naval warfare will be, no one can tell what will be the most useful weapon of such a war.

Starting from these bases, we will say, and it will be our last word, the duty of genius is to work for the future; nothing can prove that the future prepared by Colbert is finished; let this work of his hands still exist; do not touch Rochefort as a port of war. We say it is the duty of patriotism to render the present certain, when the future is undecided, and full of threatening presages; do not touch the naval port of Rochefort: are you sure that in doing so you will not destroy one of those vital forces which assure, we will not say the greatness, but the very security of our country? As we believe in the patriotism of the Minister of Marine, we have confidence and hope. We therefore believe that Rochefort will be preserved for the future of France.

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## THE SUPPLY OF AMMUNITION TO INFANTRY ON THE FIELD OF BATTLE.<sup>1</sup>

By A. MARIOTTI.

Translated by CAPTAIN S. WALLER, R.E.

### I. INTRODUCTION.

THE supply of cartridges to the infantry, and the filling up of small-arm ammunition on the field of battle, is one of the questions which most justly occupies the attention of the military world.

<sup>1</sup> *Du Remp'acement des Munitions d'Infanterie sur le Champ de Bataille*, par André Mariotti. Panp., pp. 38. Paris, 1880.

Modern small arms have, owing to their rapid fire and long range, introduced into the art of war a new factor, which has made it absolutely necessary to modify fighting tactics, and to regulate, not only the fire itself, but also the means of maintaining the intensity of that fire throughout the duration of a long engagement, by some well ordered system of supply and distribution of ammunition.

This new importance of the fire of infantry showed itself for the first time on the battle-fields of the Crimea, when improved small arms even then returned with effect the fire of artillery at long ranges, and gave evidence of considerable value in those phases of the combat in which, up till that date, artillery alone had been able to take part.

The preponderance of musketry fire as a factor in the fight became more apparent during the campaign of Italy, in 1859. The War of Bohemia in 1866 placed the question of its power beyond doubt, owing to a conversion of the *matériel*. Finally, the campaign of 1870-71, and the Russo-Turkish War of 1876-77, evidence in the most unquestionable fashion the immense value which infantry fire, vigorously sustained and skilfully directed, may attain, at the longest ranges, and in all periods of the combat, from the preparation of the attack to the defeat and pursuit of the enemy.

Far be it from us to say that confidence is to be placed *solely* in this rapid fire at considerable distances, and sometimes at unseen objects; to do so would be to commit an error the pernicious consequences of which the study even of those wars we have just cited would demonstrate time after time; but however opposed one may be to games at long bowls, there is one principle the justness of which cannot fail to be admitted, and it is this: the unquestionable effect produced by superior fire will always give a moral superiority, which is one of the surest foundations for success.

In several of the armies of Europe modifications have already taken place as regards musketry instruction, with the view to the use of long range musketry fire: we may therefore expect to find ourselves at a given moment in presence of an enemy capable of producing, by the intensity of his fire at long ranges, that useful effect which it is known may be derived from it in the present day, and it is therefore indispensable that we should be at all times ready to produce a superior effect, that is to say, to crush the enemy with a greater mass of projectiles than he can fire at us. We are thus forcibly compelled to admit the necessity of a larger consumption of cartridges than heretofore, and hence the absolute need of assuring to the infantry a continuous and sufficient supply of ammunition to replace what has been fired away, a supply which is to that arm (as says General von Scherff) "a condition of existence which must be fully and entirely satisfied."

On the other hand the absolute increase of the number of cartridges to be carried by the foot soldier is limited, on account of the fatigue which this extra burden implies: our attention then should be directed towards improvement in the organization of the method of keeping up the supply to troops in the first line of combat, quite as much as to the equipment of the soldier before the action.

"The principal objection urged against long range infantry fire," to quote from Commandant de Horsetzky's remarkable study on the tactical value of musketry fire at great distances,<sup>1</sup> "rests on the waste of ammunition. A similar objection was formerly one of the most serious obstacles to the adoption of breech-loading arms."

"What is meant by the waste of ammunition? Is every shot supposed to

<sup>1</sup> "*Étude sur la valeur tactique du tir aux grandes distances*," par le Commandant de Horsetzky, Chef d'escadron d'état, Major de l'Armée Autrichienne, published in the "*Revue de Militaire de Streffleur*" (April-May, 1878). Translated in the "*Revue Militaire de l'Étranger*" (12 Jan., 1879).

"be thrown away that does not strike the object aimed at? If so, then millions of cartridges fired at short range must be looked upon as wasted, for experience proves that even at the closest distances the average percentage of hits does not exceed one per cent.

"As a matter of fact, ammunition is judiciously expended so long as the number of rounds fired bears a suitable relation to the results which may be expected from the ballistic qualities of the arm, the distance, and the size of the object aimed at.

"A body of infantry which opens fire at long range will evidently have more opportunity of utilizing its fire, and will consequently burn more cartridges, than a body of infantry which only fires at close range. It follows that the adoption of fire at long distances necessitates an increase in the number of cartridges to be placed at the disposal of the soldier. But this is only a minor point. If it be recognized that long-distance fire is a distinct advantage, we must, to be logical, regulate the supply of ammunition by the necessities of the fight, and not make the method of action of the infantry depend on a certain allowance of cartridges fixed *à priori*. As for the measures to be taken to make sure that the troops always have a sufficient quantity of ammunition, these are matters of organization, and the latter must adapt itself to the exigencies of tactics."

In foreign armies, as well as in France, provision has been made for placing at the disposal of the infantry fighting man such a number of cartridges as will allow full play to the capabilities of the weapon with which he is armed.

This supply of ammunition, carried partly by the soldier himself, partly by wheeled carriage or *bât* animals, is fixed (according to recent documents which we have had the privilege of consulting) in the following manner :—

Manner in which the ammunition is carried.	Number of cartridges carried by each fighting man.						Observations.
	France.	Germany.	Austria.	Italy.	Russia.	Switzerland.	
By the soldier ...	78	80	70	88	60	100	<sup>1</sup> This ammunition is carried by the baggage wagons of the company, which do not always follow the troops under fire.
By regimental wheeled carriage or <i>bât</i> animals	18·1	{ 19·2 (11·5)	52·50	83	60	35	
TOTAL OF 1ST SUPPLY FOR FIGHTING LINE ...	96·1	{ 99·2 110·7	122·50	88	120	135	
By 1st line ammunition columns or divisional parks	46·4	20	22·50	50	60	35	<sup>2</sup> Plus 22·50 cartridges carried by the reserve ammunition parks of the army.
GENERAL TOTAL OF SUPPLY FOR FIELD OF BATTLE	142·5	130	145	138	180	170	
By 2nd line ammunition columns or parks of army corps	31·5	...	6 <sup>2</sup>	50	...	30	

The above table shows that the provision for the battle-field is not less in the French Army than that allowed by the principal foreign military Powers (with the exception of Russia) to their fighting men.

Must we then conclude that this supply is absolutely sufficient for the exigencies of modern combats? Such is not the opinion expressed in the 6th

portion of the "Report by the Commission on Field Firing" which assembled at the camp of Châlons in 1878, and according to which every man should have at his disposal 100 rounds, exclusive of those in the battalion wagon, and the other ammunition columns; nor is such the deduction we should draw from a study of accomplished facts during the Eastern War of 1876-77. For in the Russian Army, the consumption of ammunition during that campaign frequently reached a higher figure even than that named by the Châlons Commission, whilst in the Ottoman Army it attained proportions truly extraordinary.<sup>1</sup>

Again, the experimental firings which took place, in 1878, in the neighbourhood of Cassel during the grand manoeuvres of the 11th German Corps, and when attention was directed to an investigation of the newly discovered principles of the tactics of infantry fire, furnish us with extremely interesting results, which clearly prove that the number of rounds for the actual field of battle is still insufficient in the French Army. In fact, in every one of the manoeuvres we speak of, an average of 100 to 120 cartridges per man was expended, and this in practices which did not exceed three or four hours in point of time, during which the firing was carried out with the utmost deliberation, and the greatest economy of ammunition. What then would happen in actual warfare? In the French Army, owing to the excitement of battle, and the fiery spirit of the soldier, the consumption of ammunition would be certainly one-third, perhaps one-half more than that of the German soldier in these peace manoeuvres, and we should thus arrive at a minimum figure of 165 rounds.

It will therefore be necessary to increase very considerably the provision for the field of battle; at the same time, we may congratulate ourselves that if it be indispensable to take steps to meet this necessity, the French infantry is, nevertheless, in the actual state of affairs, so far prepared to meet any probable contingency, that the investigation of the subject may be pursued without undue haste.

But two kindred points, both urgently needing reform, require to be at once brought to notice.

- 1st. The inferiority in the quantity of ammunition which the French soldier has at his command before having recourse to the ammunition columns, even of the 1st line, in comparison with that which is placed at the disposal of the combatant in other<sup>2</sup> armies.
- 2nd. The difficulty which the French soldier has in using his ammunition owing to his present equipment.

Although we allow that the most important subject is the continued supply of ammunition, still it is also most important to furnish the combatant with the utmost possible supply at the moment when the action is about to begin.

At present, with the equipment in use in the French Army, the soldier has actually only forty cartridges ready to his hand: thirty-eight are in the knapsack, from which they have to be taken when wanted. This can only be done by placing the knapsack on the ground. The soldier who has to do this while the fight is going on, and most probably under the hottest fire, will hesitate to cease the fire he considers necessary for his personal safety, and not knowing, if he takes off his knapsack, whether he will ever see it again. This is so well understood that in every campaign in which the French Army has taken part, whenever a body of troops has been about to engage, the cartridges kept in the knapsack have been first taken out.

<sup>1</sup> According to a despatch of Said Pacha each *tabur*, of an approximate strength 700 men, was furnished with 400 boxes, containing each 1,000 rounds, that is 400,000 rounds, or 570 per man.

<sup>2</sup> Except in the Italian Army; but a speedy reform is already in contemplation.

If we consider that the soldier's equipment should be logically divided into two parts, the one holding what is necessary for the combat, and the other what is necessary for food and clothing, we are led to the conclusion that not a single cartridge should be in the knapsack. The solution of this important question would appear to lie in a pouch or ball-bag holding about sixty rounds, similar, in fact, to those very practical, but non-regulation, ball-bags carried by the Zouaves and tirailleurs. The sixty rounds in this ball-bag, added to those carried in the present pouch, would give a total supply of about one hundred rounds, which would be sufficient in any case.

Or as Commandant A. D. proposes in an article<sup>1</sup> recently published in the *Journal des Sciences Militaires*, we might adopt for the knapsack cartridges the German arrangement, which consists of two small tin boxes, placed on each side of the knapsack and covered with a flap. These two boxes hold the remainder of the cartridges which the man carries and which the pouch will not take. If a man wishes quickly to refill his pouch, or in case of his being wounded or killed, one of his comrades has but to raise the flap, and the box of ammunition is easily got at.

During the manœuvres of 1878, the Infantry "Direction" had on trial in certain regiments a *sac musette*, which at first sight seemed worthy of notice. This *sac musette* included a reserve cartridge case of waterproof cloth, which could be placed either in the knapsack, on the knapsack, or altogether separate from it. This reserve cartridge case held sixty cartridges, which, added to those carried in the present pouches, would make a supply sufficient in most cases for the most likely contingencies of the first phase of the engagement.

Since 13th August, 1880, a new system has been on trial in certain regiments of infantry. This system is based on the principle of carrying the ammunition independently of the knapsack: it allows the soldier to carry ninety-six cartridges, and to have them ready to his hand whenever he wants them. It is made up of the following:

1. A knapsack of skin with arrangements for the carriage of utensils, and braces without cross straps, weighing less than the canvas knapsack of 1876.
2. Four pouches, each holding four packets of ammunition.

Two of these pouches intended for reserve ammunition are fixed upon a leathern neckpiece, and are carried on the shoulder blades, held in position by two small straps passing over the shoulders and under the armpits. The two other pouches are carried on the waistbelt; and on the right shoulder there is a catch, to assist in carrying the rifle at the slope.

To put on the equipment, first put on the belt and pack, and then the neck-piece carrying the pouches.

To get rid of the pack, it is only necessary to unbuckle the two braces and let it slip down. The pouch arrangement still remains in place, but must be taken off before the pack can be put on again.

If it is necessary, when in action, to draw upon the reserve pouches, the soldier unfastens the cross straps, fastens them to each other by means of the catch and brings round the pouches from rear to front, the weight being for the moment supported on his neck.

The equipment comprises, in addition, a waterproof haversack, lined with a movable cloth.<sup>2</sup>

The corps experimenting are authorized to submit one set of equipment to such modifications or alterations in the course of their trials as they may consider desirable, or to make a new set in conformity with their own views.

<sup>1</sup> "Étude sur les impedimenta de l'Infanterie en Campagne." (J. des S. M., Sept., 1879).

<sup>2</sup> *L'Armée Française* (1<sup>er</sup> Septembre, 1880).

*Service of Ammunition in the French Army.*

The method of bringing up reserve ammunition to the field of battle in the French Army was fully laid down in a circular of 19th February, 1877, which notified that a battalion ammunition wagon would be attached to each battalion of infantry for the transport of the first reserve of ammunition, and was further explained by different notes and regulations (of which we will proceed to give a short summary) relative to the organization of ammunition sections of infantry, and the section of the Park, properly so called.

By the terms of the above circular of 19th February, 1877, an artillery ammunition wagon is attached to each battalion for the transport of an extra supply of ammunition.

This wagon takes ammunition boxes, model 1858, filled with cartridges, model 1874 : it actually belongs to the battalion to which it is attached.

The battalion ammunition wagons are drawn by four horses driven by mounted men, selected out of the battalion. The experience of recent wars has proved that the service of drivers for the ammunition wagons of infantry can only be properly performed by soldiers of the corps to which the wagons belong. A driver of the train or artillery rationed with an infantry corps, to act as driver of an ammunition wagon, necessarily meets with constant difficulties in the way of living : a stranger to those about him, he would have no interest in his new corps, and would probably take any opportunity for doing his work badly, simply from want of supervision.

It would, in fact, be desirable that the infantry should have charge, not only of the direction of its fighting ammunition train as well as the maintenance of the wagons, and the care of the first line of ammunition, but also of the transport of the whole of its ammunition. The infantry would carry out this task with as much care and zeal as the artillery shows in keeping up the *matériel* of which it has charge, and would be better able to utilize the resources at its disposal, since this arm would, under such circumstances, have most liberty of action, and henceforward greater responsibility.

These are no new ideas : they have been put forward by authorities infinitely greater than ourselves ; still a good thing can hardly be too frequently repeated. Without, therefore, further enlarging on this subject, which in this case is only of collateral interest and does not enter altogether into the scope of the present article, we will limit ourselves to giving an extract from an interesting study entitled, "*Essai d'Organisation de l'Artillerie*," which an Officer of that branch of the Service published in 1877 :—

"The troops using small arms should properly carry out this service. They ought to be better fitted to judge of the conditions necessary for their use. The infantry should therefore find the transport for its own ammunition, since it will know better than any other arm what amount of supply it ought to have, and the points where the supplies should be assembled.

"If the solution has not been adopted up to the present time, it is no doubt owing to the spirit of prejudice which has always existed in the different arms.

"It will not do to say that the infantry is not capable of performing this service. This reason, even if it existed, is not valid. If such incapacity exists, it should cease : the means are not wanting. But it does not exist ; the many useful works written by Officers of infantry attest this fact.

"It is true that the infantry, shut out from the manufacture and transport of its arms and ammunition, has too completely washed its hands of the matter. We are convinced that from the day these services are delivered over to its keeping, hard-working and intelligent Officers will not be wanting to carry them out thoroughly.

"The infantry too finds it in a certain way more convenient to make a demand on the artillery for its ammunition but there are numerous

"disadvantages; for that arm, having in no degree the responsibility of the care of its ammunition, is much too wasteful of it. If the artillery finds difficulties in the transport of cartridges, what does that matter to the infantry? It is never even thought of. If the artillery cannot satisfy the demands of the infantry there is friction. To those who cry out, 'We have no more ammunition!' nobody ever thinks of saying, 'What have you done with it?' At any rate, from whatever source the mistake arises, the harm is done, and the artillery is bound to repair it.

"By giving to the infantry the complete service of its arms and ammunition, the clashing of interests would be avoided, and a notable economy in the consumption of ammunition would result, for the infantry would be more judicious in expending cartridges when it became fully aware of the difficulty of supplying them."

The drivers of ammunition wagons have, with the exception of small details (overalls, &c.), no other uniform than that of their regiment or battalion: they are trained as drivers, either in the regiments of artillery, or in the squadrons of the train, which are in the neighbourhood of the garrisons to which they belong. For the last two years men have been selected for this service in all regiments.

The ammunition wagon is composed of two parts: the limber, and the body, joined by an eye at the extremity of the pole of the body, which fits on to a spring hook on the limber.

There are three boxes: one on the limber and two on the wagon; they are not permanently fixed, but each has on its under side special appliances for attaching it to the wagon; the boxes are divided into two unequal partitions called right and left.

The cartridges are loaded into the boxes by cases, they are previously enclosed in canvas-covered bundles furnished with a handle; each bundle contains 28 packets, and each packet 6 cartridges.

The right case holds 12 bundles, *i.e.*, 336 packets of cartridges, together with 4 canvas wallets, for the transportation of the cartridges from the wagon to the combatants. The left case contains 24 bundles, *i.e.*, 672 packets and 8 wallets.

The load of each box is therefore 36 bundles, or 1,008 packets containing 6,048 cartridges, together with 36 wallets.

The wallets for the transport of ammunition consist of a rectangle of canvas folded in half in the direction of its length, sewn at the ends and opposite the fold, where opening is left, 36 centimetres in length.

A squad of 3 well trained men, one loading and two supplying, can load a box in five minutes, and empty it in a slightly shorter time.

We have seen above that, in addition to the 96 rounds per man carried by the infantry soldier, 77 rounds per man are carried by the artillery park of the army corps.

The artillery park of an army corps is divided into two *échelons*; the first *échelon*, which furnishes an immediate reserve to the infantry and artillery, comprises 6 sections.

Of these sections, Nos. 1 and 2 are charged with the transport of small-arm ammunition: they carry 46 rounds per man. Sections 3 to 6 carry artillery ammunition.

The 2nd *échelon* carries 31 rounds of small-arm ammunition per man, and a reserve of artillery ammunition to replenish the sections of the first *échelon*. It also carries materials for the repair of ordnance and wagons. It is divided into 4 sections, of which the 3 first draw 15 wagons of small-arm ammunition.

#### *Sections of Small-arm Ammunition.*

Sections Nos. 1 and 2, of the 1st *échelon* of the artillery park, are composed as follows:—

Small-arm ammunition wagons (pattern 1858),	} 32
four horses ....	
Forge (pattern 1858), 4 horses....	1
Battery wagon (pattern 1858), 4 horses	1
Forage wagon, 6 horses	1
Commissariat wagons, 2 horses	3
Total ...	38

The wagons drawn by Sections 1 and 2 are similar to the battalion wagons already described. They each contain 18,144 rounds. In each section one of the front wagon boxes is loaded with revolver cartridges.

Each section therefore carries 574,560 rifle, and 11,285 revolver cartridges.

The *personnel* of Nos. 1 and 2 sections is furnished by the divisional regiment of the artillery brigade, and consists of—1 Second Captain, 2 Lieutenants or *sous-Lieutenants* of the Reserve, 1 Quartermaster-in-Chief, and 7 other Quartermasters, one of which is an artificer, 1 Quartermaster sergeant, 6 corporals, 1 farrier, 2 shoeing smiths, 2 smiths, 2 carpenters, 6 artificers, 2 collar-makers, 2 trumpeters, and about 150 drivers.

#### *Sections of Park, Nos. 1, 2, 3 of 2nd Échelon.*

These sections comprise each 45 wagons, as follows :—

Gun carriages of 90	....	....	....	....	3
Do. of 80	....	....	....	....	1
Artillery ammunition wagons of 90	....	....	....	....	18
Do. do. do. of 80	....	....	....	....	4
Infantry ammunition wagons (1858)	....	....	....	....	15
Revolver do. do. do.	....	....	....	....	1
Forage (pattern 1827 improved)	....	....	....	....	1
Harness cart	....	....	....	....	1
Forage cart	....	....	....	....	1

45

Each of these sections carries, in addition, on its gun carriages, a spare piece of 90, and No. 1 carries also a spare piece of 80.

Each of the 15 wagons attached to Nos. 1, 2 and 3 sections carries its complement of 18,144 rounds, giving 272,160 rounds per section.

The *personnel* of each section is furnished by the train of the Army Corps Artillery Brigade, and consists of 1 Captain, 2 Lieutenants, or *sous-Lieutenants*, (one to belong to the reserve), 1 Adjutant, 1 Chief Quartermaster, 7 other Quartermasters, one of which to be a Quartermaster sergeant, 1 farrier, 2 shoeing smiths, 2 collar-makers, 2 trumpeters, and the necessary number of conductors, viz., about 370.

We have already said that, in each section of small-arm ammunition, one wagon has its front box loaded with revolver cartridges, *i.e.*, 11,285 cartridges per section. Section No. 4, of the 2nd *échelon*, contains in addition 3 wagons, devoted to the transport of revolver cartridges for all arms : each wagon contains 33,858 revolver cartridges.

There is no special small-arm ammunition reserve constituted for any other branch besides the infantry. In case of need they may draw on the infantry reserve. There is, however, in the independent cavalry divisions, a reserve of 3 cartridge wagons per division, the front box of each wagon containing revolver ammunition.

The ammunition wagon (pattern 1858) has been tried in the army corps,

during the grand manœuvres of the two past years, and is universally considered to fulfil all the requisites of strength and mobility. The wagon has passed with ease along difficult roads, traversed streams, climbed steep slopes, in a word, gone everywhere where it is possible to take a wagon, and always been able to keep within convenient reach of the troops of the 1st line. If on some exceptional occasions this was not the case, it was due to the operations having taken place in country so thickly wooded or intersected as to forbid the passage of even the lightest vehicle, and partly perhaps also to the inexperience of the conductors. But on the one hand *la grande guerre* is seldom made in country such as the above, and should it so happen, special provisions for transport would have to be improvised; on the other hand, the training of conductors was yet in its infancy in 1878, since when soldiers have been selected for the service already accustomed to carriage work, the course of instruction has been approved, and it may be predicted that the very rare accidents already chronicled will not be repeated.

There are no regulations in France as to the relations which should exist between the battalion carts and the ammunition sections of the troops engaged. At present the replenishing of ammunition is done, in the battalion, upon the demand of the Captains by the battalion carts, in the regiment, on demand of the Colonel, by means of the small-arm ammunition sections of the divisional train. The troops engaged provide themselves with ammunition; the men told off for the purpose go to the cart—take a wallet, place in it 60 packets of cartridges, and carry it to the firing line. But this mode of action has no official sanction, nothing having as yet been promulgated as to who is to carry the ammunition from the reserve to the troops engaged, or in what manner it is to be done.

From what we have just seen it would appear that the method of bringing ammunition on to the battle-field is sufficiently well defined, and the material employed satisfactory, but nothing has to this day been settled concerning the important question of the method of transporting ammunition from the carts to the combatants, or from the ammunition columns to the carts.

It is by examining the methods employed in foreign armies, and profiting by our own experience in France since 1878, that we must hope to gather some useful ideas for the solution of this problem.

#### SUPPLY OF AMMUNITION IN FOREIGN ARMIES.

##### *The German Army.*

In the German Army ammunition is carried—

- 1st. By the soldier.
- 2nd. By the company baggage wagons.
- 3rd. By the small-arm ammunition wagons of battalions.
- 4th. By the ammunition columns.

The soldier carries on his person 80 rounds: 40 in the pouch, 40 in the knapsack.

The company baggage wagons carry each 2,880 cartridges in 3 boxes, or 11·5 cartridges per man. The battalion wagons hold a supply of 19,200 rounds in 20 boxes, containing each 960 cartridges, or 19·2 per man.

Thus, in theory, the German foot soldier has at his disposal 110·7 rounds in the battle, but the baggage wagons rarely follow the troops under fire, and the first supply of the soldier is but 92·2 cartridges per man.

In addition to the rounds carried by the soldier, by the company baggage wagons, and by the battalion wagons, the ammunition in the wagons of the first section (*échelon*) of the ammunition columns, which forms part of the fighting train, is a second reserve. These wagons hold a supply calculated at

20 rounds per man, which gives the German soldier a supply of 130 rounds each day.

As we have said, the company baggage wagons are not, as a rule, destined to follow the troops on to the field, and to replace ammunition during the fight. They are intended principally for supplying the men when halted. These wagons are filled up by the first section of the army corps ammunition columns.

The battalion wagons are of iron, and of a similar model to the ammunition wagons of the German Field Artillery.

These wagons are driven, as in France, by men taken from the corps to which the wagons are attached. In each battalion of infantry or chasseurs there ought always be two sub-officers and two men well acquainted with the driving and management of ammunition wagons. To replace those who go each year, the battalion detaches the number required to the nearest batteries of field artillery. They remain there four weeks, learn to harness, load, and drive the ammunition wagons, and are well instructed in all matters relating to the supply of ammunition during and after the fight. They receive, as well, the instruction indispensably requisite for a sub-officer acting as commander of a convoy. A special manual, printed by order of the Commander of the army corps, is given to each of these men.

Besides this, every battalion of infantry, chasseurs, pioneers, and foot artillery has to detach six men every year to regiments of cavalry, or field artillery, that they may be taught the duties of drivers and mounted orderlies. They learn to ride, to groom, to look after and saddle a horse, they get some notions about veterinary matters, and are instructed in their duties on the line of march and in cantonments. Men attached to field artillery have to learn as far as possible to drive from the box, as well as when mounted. This special instruction is entered in the man's pocket ledger. These men do duty as orderlies to mounted Officers, or as drivers.<sup>1</sup>

The ammunition wagons of the battalion station themselves, from the commencement of the action, close to the troops they are to supply, and as much as possible in a sheltered spot.

Their position is marked at once by a camp colour, with a black square in the centre, placed at a certain distance from the wagon on some spot whence the latter may be easily seen. At night this camp colour is replaced by a green lantern, hung at the top of a long pole. If necessary, communication between the battalion and its wagon is kept up by mounted orderlies. It may be added that the ammunition wagons of infantry in the German Army are painted grey, which makes it easy at a distance to distinguish them from the artillery ammunition wagons painted blue. This difference of colour between the two different sets of wagons, which at first seems only a simple method of detail, very much simplifies the arrangements of supplying ammunition, and a general order of Prince Frederick Charles during the campaign of 1870, calling attention to its importance, will be in the memory of our readers.

As soon as the wagons have taken up their positions, and the action begins, two or three men per company, detailed beforehand and practised in their work, are marched under the command of a sub-officer to the wagons to get ammunition. These men take off their knapsacks and equipment; they are thus entirely free to perform the duty assigned to them.

The sub-officer gives to each a bag of sacking holding 500 cartridges (39½ to 44 lbs.) which is considered about the maximum weight a man can carry a considerable distance in difficult ground. They then hurry back to the troops engaged, and distribute the ammunition. They return at once to the wagons, and so on as long as is required.

When a line of fixed positions has to be defended, the regulation lays down

<sup>1</sup> *Revue Militaire de l'Étranger* (4th September, 1875).

that a number of small dépôts must be supplied before the action, all along the line. "The supply of ammunition," says the Prussian Regulation of 15th November, 1877, on Infantry Fire, "ought on the defensive to be assured beforehand by supplies placed close to the firing line. On the offensive the supply of ammunition must be thought of and completed before the troops are sent forward to the attack. The cartridges even of the killed and wounded may be utilized."

Troops in action may replenish their pouches from the nearest wagons, whether belonging to them or not. The battalion ammunition wagons fill from the first section of the army corps ammunition trains.

Each army corps has ten ammunition columns divided into two sections (*Staffel*), comprising each two columns infantry ammunition, and three columns artillery ammunition. The first section marches with the troops, the second, further in rear, is meant to fill up the former, and itself receives its supplies from the field park ammunition column, or from intermediate dépôts.

The infantry ammunition column consists of 21 ammunition wagons, 1 battery wagon, 1 forge, 1 baggage wagon.

This column is sub-divided into two divisions or *Abtheilungen*, one comprising 9 ammunition wagons, the battery wagon, the forge and baggage wagon, the other consisting of 12 ammunition wagons.

The *Adjutants de Bataillon* have the special duty of seeing to the service of the filling up of the small-arm ammunition wagons. It seems to us that the sub-officer in charge of the wagon might perfectly well do this, more especially as he has received instruction for this purpose. The *Adjudant de Bataillon* is otherwise too much absorbed with this duty, and unable to render any assistance to his battalion Commander, whose most valuable assistant he should be.

As soon as a wagon gets empty it should immediately be taken to the nearest ammunition column, where the empty boxes are changed for full ones. But, as this arrangement may make the supply a matter of time, the Commander of the first section of the ammunition columns may, if he thinks fit, and must, if he is ordered, send forward a certain number of his wagons to those points where there appears to be a rapid consumption of ammunition. "The infantry ammunition wagons belonging to the columns," says the Bavarian instruction, 16th July, 1875, "then take the place of the battalion ammunition wagons which are becoming empty, and supply the troops fighting, till the empty wagons have had the time to get to the ammunition columns, and complete their loading." We draw attention to this system, which has the advantage of giving a fresh supply as rapidly as possible, without the slightest drawback.

The empty wagons of the first section are sent as soon as possible, by groups under a sub-officer, to the second section of the army corps ammunition columns, where they remain temporarily. In their place, a column, filled from the second, is immediately sent to the first section.

#### *Austro-Hungarian Army.*

By the terms of decision of 8th December, 1879, the fighting equipment of the Infantry of the Line and Chasseurs of the Austro-Hungarian Army is 145 rounds, arranged as follows :—

70	rounds on the soldier's person.
59.50	" in the battalion ammunition wagons.
22.50	" in the divisional park.

The men of the technical troops (engineers and pioneers) carry 30 cartridges per rifle.

The non-commissioned officers of the infantry of the line, chasseurs, and technical troops are only furnished with 20 rounds in the field.

At the commencement of an engagement, an extra packet containing 10 rounds, from the battalion ammunition wagon, is given to each soldier of the infantry of the line and chasseurs, which raises his immediate supply to 80 rounds.

Every battalion of infantry or chasseurs has permanently with it two small-arm ammunition wagons drawn by four horses, and holding each 21,000 cartridges, model 1877, say for the battalion 52·50 rounds per man: these ammunition wagons fill up from the divisional parks.

The divisional ammunition park is the one attached to an infantry division forming part of an army corps. It consists of about 200 men, 200 horses, and 39 carriages; carries 82 rounds per 9<sup>e</sup> gun, and 22·50 cartridges for each infantry soldier.

The independent divisions of infantry have a special divisional park which carries—

30	rounds per infantry rifle.
15	” ” rifle for technical troops.
35	” ” cavalry carbine.
18	” ” revolver carbine.

In addition to an ammunition reserve for the artillery, viz., 100 rounds per 8<sup>e</sup> gun, and 110 rounds per 9<sup>e</sup> gun.

Parallel, so to speak, with the divisional parks are the ammunition parks of the army corps which perform the same service to the non-divisional troops of the army corps as the former do to the divisional troops.

The ammunition park of the army corps consists of 250 men, 260 horses, and 51 carriages. Its complement of infantry ammunition is only 15 rounds per rifle for technical troops; it carries also 18 rounds per revolver, 18 rounds per cavalry carbine, 74 rounds per 8<sup>e</sup> gun, 82 rounds per 9<sup>e</sup> gun, and a certain supply of powder and dynamite.

The above form what is called in Austria the first line of establishments of Artillery Reserve (*Artillerie Reserve-Austellen*). They fill up from the reserve establishments of the second line, which comprise the army ammunition parks, the reserve army ammunition parks, the field dépôts of army ammunition, and the artillery siege parks.

The supplies in these establishments of the second line are :—

- I. Army ammunition park—
  - 6 rounds per infantry rifle.
  - 6 ” ” rifle for technical troops.
- II. Reserve army ammunition park—
  - 22·50 rounds per infantry rifle.
  - 15 ” ” rifle for technical troops.
- III. Field dépôts of army ammunition—
  - 45 rounds per infantry rifle.
  - 22·5 ” ” rifle for technical troops.

The regulations for the working of the service of the supply of ammunition during the fight were laid down in a Ministerial explanatory circular, approved by the Emperor on 17th May, 1877, of which the complete text is given below<sup>1</sup> :—

1. Commanders of regiments and battalions are to be careful to see that the number of rounds to be carried by the men is always complete.

<sup>1</sup> Translated in “*Revue Militaire de l'Étranger*,” No. 375. These regulations were drawn up before the battalions had two small-arm ammunition wagons attached to them; there will be therefore some modification of detail in carrying out these instructions, but the general outlines remain the same.

2. Every pause in the fight is to be utilized for replacing without delay the ammunition expended.

3. As a general rule, the ammunition wagons of the battalion follow their respective battalions on to the field.

4. It is the duty of battalion Commanders to regulate the proper positions of these wagons.

5. If the nature of the ground, or the circumstances of the fight, absolutely prevent the wagons from following their own battalions, they may be massed by regiments.

If all the companies of a battalion come up into the line of fire, the ammunition wagon of the battalion takes post with the reserve of the regiment.

In a battalion acting singly, the battalion Commandant, in a similar case, takes the necessary measures for assuring the safety of his ammunition wagon.

6. During the action, the ammunition wagons, while keeping under shelter from the enemy's fire, should be advanced as close as possible to the troops engaged, so that the filling up of ammunition may take place without difficulty and loss of time.

7. The position of the ammunition wagons is indicated in the daytime by a red camp colour, at night by a green lantern. These signals should be established in such a manner as not to draw the attention and fire of the enemy on the ammunition wagons. Thus, the camp colours should not be placed close beside the wagons, but a little distance off, at some point from which the carriages may be easily seen.

8. The cartridges should be first taken from the body of the wagon until it is empty. Recourse should not be had to the supply in the limber until unavoidable.

9. In all companies receiving the order to engage, an extra packet of cartridges, taken from the battalion wagon, is distributed to every man.

10. If the wagons have been unable to follow the troops closely, Captains of companies send a fatigue party under a non-commissioned officer to bring up the required number of rounds. Drummers, buglers, and pioneers should be specially employed in this service. The fatigue party take the ammunition bags out of the wagons, fill them, and carry them to their company.

11. If ammunition is to be supplied exceptionally during the action, it may be carried by the groups proceeding to reinforce the line of fire.

12. If another corps asks for ammunition, the demand is complied with, either wholly or in part, according to the urgency of the case, and the quantity remaining for disposal. No formal demand nor receipt is to be exacted. The non-commissioned officer in charge of each wagon simply keeps an account of the number of rounds he delivers, both to his own and to other corps.

13. When an ammunition wagon becomes empty, it is taken to the divisional ammunition park: the horses are attached to a full wagon, which is immediately driven to the troops. The battalion ammunition wagons which are only partly emptied should, immediately after the action, be sent to fill up from the divisional park. If all the wagons of the regiment are in this state, the complement of one of them may be filled up from the ammunition remaining in the others, after which the latter should be driven to the park.

14. The ammunition is to be taken from the killed and wounded to be divided among the men in the ranks.

These arrangements present two points worthy of note—

1st. The distribution of an extra supply of ammunition immediately before the action, an excellent measure which gives confidence to the soldier, and allows him to keep up a good fire from the beginning of the fight.

2nd. The replacement of ammunition by reinforcing troops, who carry it with them into the line of fire, and distribute it to the fighting line.

This would certainly be by far the best arrangement if we could be certain—

- (1st) That the reinforcements will always mix with the troops of the first line, whereas it will frequently happen that the line will be reinforced by extending the chain.
- (2nd) That the soldier, once in the line of fire, will consent to part with a portion of the ammunition he carries for the benefit of his neighbours.

This method has, in any case, the great advantage of not weakening the line of fire, and if not always practicable, it is no less certain that it may be usefully employed in numerous cases.

#### *The Italian Army.*

In Italy, up to the present time, no regulation has been issued on the subject of the recent employment of infantry fire. Consequently, the important question of the supply of ammunition on the field of battle is still in abeyance. At the same time the Italian Minister of War has not lost sight of the progress made in these matters in foreign armies. We know that studies of these questions are being vigorously carried out, and the results will shortly be known.

Moreover, the personal supply of the Italian soldier was fixed some years ago with so much liberality that he had at that time a considerable superiority in this respect over the fighting portion of any other European army; and that even now he would be able to meet the requirements of the first portion of the combat, notwithstanding the succession of improvements by other nations in the service of ammunition.

The supply consists of—

88 rounds carried by the soldier.

50 " " " divisional artillery park.

50 " " " corps artillery park.

Without counting the 26,000 reserve cartridges forming portion of the equipment of every mountain battery.

It will thus be seen that, owing to the number of rounds on the soldier's person, the question of supply during the action did not so seriously touch Italy as it did other nations; but it is no less certain that this supply would be insufficient at the present day to carry on a long engagement, and that the necessity of having recourse in case of need to a distant park, often some miles away, constitutes a defect in organization which cannot be too soon remedied.

#### *Dutch Army.*

A provisional regulation, dated 7th August, 1879, introduced the employment of long-range fire in the Dutch Army, and in consequence, decided the method of issuing the supply of ammunition during the fight.

Every soldier in the Dutch Army carries 60 rounds: 20 in the knapsack and 40 in the pouch. In addition, 8 ammunition wagons are attached to each division of infantry for the transport of small-arm ammunition. These wagons are of wood, and arranged for harnessing one, two, or three horses as leaders. They carry a great many pioneers' tools, and hold each 12,800 rifle and carbine cartridges, and 1,728 revolver cartridges.

The regulation, 7th August, 1879, lays down that the ammunition wagons should be, during the action, as close as possible to the troops which it is their business to supply, but that they should always be careful to take shelter from the enemy's fire. At the commencement of the action, certain men are told off in each fighting unit to bring up supplies of ammunition from the wagons.

The regulation does not specify the number of these "feeders," nor any other particulars.

In defensive positions, and as a rule wherever it is possible, it is recommended that small depôts of ammunition should be established.

The soldier's personal supply of ammunition should be filled up immediately after the action.

#### *The Russian Army.*

In the Russian Army, 150 rounds per man are allotted in the field, distributed as follows :—

On the soldier 60 rounds : 30 in the pouch, 30 in the knapsack.

In the regimental wagons, 60 rounds per man.

In the convoy of the first section of the train, 60 rounds per man.

An ammunition wagon is set apart for each company of infantry. It contains 945 packets of 12 rounds each, making 11,340 rounds, which, allowing a strength of 189 men per company, gives 60 rounds per man.

These wagons are in charge of men belonging to the company under a *sous-officier*.

A further supply of ammunition is obtainable from the artillery parks which move with the army, and from the reserve depôts.

The field parks are formed into two sections, the first the *parc volant*, the second the *parc mobile*.

There are two sorts of *parcs volants* : the one *divisional*, charged with the supply of the infantry divisions ; the other supplying cavalry and chasseurs, and attached to divisions or brigades of cavalry.

Each divisional park comprises 3 sections of artillery : 2 of infantry, and 1 of intendants. An artillery section has 22 four-wheeled wagons, infantry section 32 wagons, and a tool wagon. The intendants train has 1 wagon for treasure and archives, 5 for provisions, 1 ambulance and a medical cart.

There are 48 divisional *parcs volants* allotted to the 48 infantry divisions of the Active Army, the numbers of the parks and divisions not necessarily corresponding.

In peace time 41 parks are stationed in Russia in Europe, the remaining 7 (Nos. 42 to 48) in the Caucasus. These parks are always manned. They are commanded by a Colonel or Lieutenant-Colonel. The strength of each artillery section consists of 2 Officers, 1 clerk, 9 *sous-officiers*, 121 men, and 15 non-combatants ; of an infantry section, of 2 Officers, 9 *sous-officiers*, 171 troopers, and 15 non-combatants.

The cavalry parks comprise 23 cavalry sections, and 7 for chasseurs. A cavalry section is composed of 24 wagons, 1 tool wagon, and an intendants train. A chasseur section has 26 wagons, a tool wagon, and an intendants train. 20 cavalry and 6 chasseur sections are stationed in Europe, the remainder in the Caucasus. These sections are each commanded by a Captain, with a strength of one Lieutenant or *sous-Lieutenant*, 1 clerk, 9 *sous-officiers*, 131 or 91 men, and 18 non-combatants.

There are 14 *parcs mobiles* : 12 in Europe, 1 in the Caucasus, and 1 in progress of formation. They have no *cadres* in time of peace, and their *matériel* is stored in the artillery depôts. Each *parc mobile* is divided into 4 sections, each section is comprised of 48 wagons, and an intendants train. The *personnel* is 1 Captain, 1 Lieutenant, 1 clerk, 9 *sous-officiers*, 200 men, and 25 non-combatants.

The reserve depôts are established in war time along the base of operations, and are pushed to the front as opportunity offers. These depôts are of different kinds, and are distinguished as follows :—

The advanced artillery depôt, which supplies the artillery with a reserve of men, horses, and material, and the other branches of the service with

arms. It has shops for the execution of repairs, but does not supply ammunition.

The field depôt, which acts as a reserve to the field parks.

The provisional depôt for fire-arms.

The composition of these establishments is regulated by the requirements of the moment.

The company wagons always follow their company when it is detached. At other times they are grouped by battalions.

When a battalion goes into action, it is followed by one only of its four wagons, which keeps close to the battalion, making every use of cover. The three other wagons remain in reserve.

The position of the wagon is marked by a large white flag, which at night is replaced by a green lantern.

Before the commencement of the action two men are detached from each company, told off to the wagon, and charged with keeping up the supply of ammunition to their company. They carry the cartridges in bags close up to the firing line, each man alternately carrying the bags and the arms of his comrade.

The bags are emptied on the ground, and the men engaged help themselves from the heaps—a method which seems likely to cause much confusion in the firing line, and a great waste of ammunition.

Each Russian company of infantry carries a colour, which serves as a guide to the men bringing up ammunition. On the other hand the white flag of the ammunition wagon enables them to regain it.

The Commandant of battalion, in accordance with the order issued on the 17th June, 1879, is held responsible for the supply of ammunition to the companies. If necessary, he is accompanied by a mounted orderly of the train to keep up connection between the battalion and its wagons.

When a wagon is empty, it is immediately replaced by a full one from the second section of the train.

During the last war, the ammunition wagons did not, in mountainous countries, give entire satisfaction. They were found to be heavy and difficult to manage, and a number of Russian military writers have advocated a much lighter carriage, and other important changes in the method of supplying ammunition on the battle-field.

Amongst the most interesting of these writers is M. le General Baron Zedeler, especially as regards his advocacy of the use of bât horses, his proposed arrangements for which are as follows :—<sup>1</sup>

The present ammunition wagon to be replaced by a light two-wheeled cart of the pattern known as a medicine cart, to be drawn by three horses.

“(a) Divide the sixteen regimental carts into two sections ; the first section composed of eight carts (two per battalion) to be always near the regiment ; the second section to march at the tail of the column with the second line of artillery wagons. The first section to be commanded by the Ordnance Officer ; the second by an Officer of the Special Employment Corps. Each pair of carts to be in charge of a mounted non-combatant conductor, and each cart to have two soldiers and horses with pack-saddles attached.

“(b) As soon as the regiment is assigned for action, the first section which accompanies it halts and forms up clear of the road, as much as possible out of fire.

“(c) The Officer in charge having formed up his section, as above, and relegated the command to the senior conductor, reports to the Commandant of the regiment, informs him of the position of the section, and receives his orders. Whilst going and returning he examines the ground, and selects the best route for his pack-horses.

<sup>1</sup> Translation given in the *Revue Militaire de l'Étranger*, No. 477.

"(d) Immediately the section is formed up, the bags are filled with cartridges and attached to the pack-saddles of the two outside horses (of the team of three), which are unharnessed from the cart ; each horse is led by one of the men of the escort.

"(e) The carts are emptied one after the other ; as soon as two or three are empty they are sent back to the position of the second section under the charge of a conductor.

"(f) On the receipt of orders for pack-horses to close up to the front, they advance under direction of the Ordnance Officer, with a conductor in charge of every four horses. Arrived within the zone of fire, they separate into groups of four, open out, and join such portions of the force as the Officer may direct. If a horse is shot, the man remains beside it, and awaits the arrival either of a fresh horse or of the men told off to carry the bags. If a man is wounded, the conductor takes charge of his horse.

"(g) When the pack-horses have reached the points designated, or the reserve companies of the battalion, the Commandant of the battalion, influenced by considerations of ground and the phase of the action, directs them on the companies of the first line. Detachments from the reserve battalion, commanded by *sous-officiers*, are told off to carry the cartridges. The bags having reached their destination, the pack-horses are sent back to the first section, either singly or in groups.<sup>1</sup>

"(h) In proportion as the horses rejoin the first section, they are reloaded as above ; disabled men and horses are replaced by others requisitioned from the second section.

"(i) Arrived on the battle-field, the second section forms up out of fire, quits the road if necessary, and makes good its approaches. At the same time the section Commander sends a conductor to the Commandant of the regiment, informing him of the arrival and position of the section, information which is also given to the Commander of the first section.

"(j) On the arrival of empty carts belonging to the first section, or on receipt of an order, the Commander of the second section immediately sends to the front the number of carts required, accompanied by their conductors and escort, and under the guidance of the *sous-officier* who has brought either the carts or orders from the front.

"(k) The *parc volant* takes the necessary steps to arrive upon the battle-field in sufficient time ; it is posted well out of fire by instructions of the Commander-in-Chief, or Divisional General.

"(l) The carts of the second section which return empty, and even, if necessary, some of those of the first section, are sent under the senior conductor to the *parc volant* to renew their supply and to replace disabled horses."

#### *The Swiss Army.*

The arrangements for the supply of ammunition in the Federal Army were fixed by an order, approved by the Swiss War Department, dated the 4th August, 1879, and are as follows :—

The Swiss infantry soldier carries 100 rounds of ammunition, of which 40 are carried in the pouch and 60 in the knapsack. A first reserve of 35 rounds per man is carried in the battalion *demi-caissons* ; another reserve of 35 rounds is carried in second line by other battalion *demi-caissons*, and, finally, a third reserve of 30 rounds is either carried in the third line of ammunition columns or stored in *dépôts*.

The *demi-caissons* of the first line are two per battalion of fusiliers and

<sup>1</sup> The bags are not sent back, but remain with the companies to the end of the action. To provide for loss, each cart contains a double supply of bags.

carabineers; they each hold 12,000 rounds, packed in four or eight boxes, and 200 rounds of revolver ammunition. Each *demi-caisson* carries four canvas bags for the transport of ammunition.

Two *demi-caissons*, similar to the above, are attached in second line to each battalion of fusiliers and carabineers; they form part of the first section of each divisional convoy.

A *demi-caisson* per battalion, or a *caisson* per two battalions, form part of the third line of ammunition columns.

The *caissons* of the first line are combined by brigades with the battalion baggage wagons, under the command of a Lieutenant of the train, attached to the brigade Staff. These eighteen wagons form a brigade unit which is divided into two regimental units, comprising each six *caissons* and three baggage wagons, under the command of an Adjutant *sous-officier*.

The two *demi-caissons* and the wagon of the carabineers form a unit of themselves, and are attached to the leading company of the regiment.

Two guides are attached to the Officer of the train, for purposes of communication. The train Officer commanding the brigade unit receives his orders from the Commandant of brigade.

The second ammunition line comprises the divisional park, which is divided into columns, under the orders of a Commander of divisional park. Each of the columns is commanded by a Captain, and is divided into three sections and a reserve. The first section carries small-arm ammunition and pioneers' tools; the second has charge of three guns of reserve and their three wagons; the third carries artillery ammunition in nine wagons. Each of these sections, as also the reserve, is commanded by an Officer. The Commandant of the park takes orders from the Brigadier of artillery.

The third ammunition line consists of the *dépôt*, wherever it may be, and is either stored in wagons, or in magazines. The *dépôt* is commanded by a superior Officer of artillery, and manned by detachments of artillery and landwehr.

During the advance of a column the main body is followed by the first line of ammunition; in a retreat the order is reversed.

In action, the brigade park takes position near the reserves, about 600 mètres from the firing line, and opposite the centre of the brigade or regiment. Every preparation should be at once made for expediting the transport of ammunition to points where it is likely to be required; the wagons should be kept as much as possible under cover. The Lieutenant of the train sends one of his orderlies to make known his position to the Commandant of the regiment, who, in his turn, passes the information to the Commandants of battalions.

In the meantime, the second ammunition line, under the direction of the Brigadier of artillery, will take position about 1,000 mètres in rear of the centre of the brigade columns. It will remain parked under cover and near roads leading to the front, so placed that it can either advance or retire without blocking the communications. Single subdivisions of small-arm or artillery ammunition may, according to circumstances, be detached from the park. The Commandant of the park is responsible for his communications to the front, and must take early measures to establish them. The Commandants of brigades and regiments of infantry and artillery are informed of the position of the park. The second division of the park approaches during action to three or four kilomètres from the columns.

Each Officer in charge of an unit must make arrangements to ensure ammunition being delivered to the front as soon as required. When a request for more ammunition is received from a Commandant of an *échelon* of brigade or of a regiment, he causes the necessary *demi-caisson* to advance to the point indicated under charge of a *sous-officier*. The Commandant who has made the demand sends to meet him a party of four men per *demi-caisson* under a *sous-*

*officier*. Each man carries in a canvas bag as many cartridges as possible, and distributes them along the firing line.

The cartridges being delivered, the bags are sent back to the *demi-caissons*. The empty *demi-caissons* are sent back two at a time to the divisional park, full boxes are substituted for the empty ones, and they rejoin their section, unless it be considered more convenient to at once substitute loaded *caissons* for the empty ones. The Officer in charge of a section must, during an action, respond to every demand for ammunition, taking a receipt for the same.

The park will equally respond to all demands, taking a receipt. It collects, in addition, all empty and damaged carriages returning from the front.

After the action, the Infantry brigades will replenish their ammunition from the first section.

Each brigade, after having filled up a certain number of its *demi-caissons* from those partially used, will send the remainder to the park to be refilled.

The Commandant of *dépôts* makes every effort to expedite the transmission of ammunition to the divisional park, either by regular wagons, impressed vehicles, or railway.

Difficulties of ground do not admit of the infantry being accompanied by their *demi-caisson*, the ammunition is carried either by men or pack-horses.

#### REMARKS ON THE VARIOUS SYSTEMS, FRENCH AND FOREIGN.

Without recurring to the evident necessity that a soldier should carry as many rounds as possible on his person, and confining our remarks solely to the system of supplying him on the actual field of battle, we would divide the subject into three distinct heads :

- 1st. The conduct and position of the ammunition wagon.
- 2nd. The supply of engaged troops from the wagon.
- 3rd. The replenishment of the wagon itself from the ammunition train.

##### I. *The Conduct and Position of the Wagon.*

We have cited above the causes which have led, in France, to the conductors of the ammunition wagon being infantry men, taken from the battalion to which the wagon is attached. A similar arrangement is adopted by all foreign Powers, and the necessity and desirability of it would thus seem to be amply justified. But it is necessary that the infantry conductors should receive such a training as shall make them handy with and serviceable to their wagons.

By these means, the prejudice still entertained by many people against what they call *impedimenta* being attached to infantry would be overcome. The wagons, well found and well manned by men of the battalion or regiment, so far from being a hindrance, would become a valuable adjunct, increasing the value of the troops by ensuring certainty of supply.

A *sous-officier* firm, intelligent, and capable of initiative, is indispensable as a guide for the wagons, to choose their ground, to superintend the distribution of ammunition, and the renewal of the wagons. In almost all foreign armies, such *sous-officiers* already exist, and it would be well if men for the post could be selected in France, while she is still at peace.

Also it is very necessary that a certain number of men from each battalion should be exercised in the service of ammunition, from whom would be selected the men to load and unload the wagons, and to purvey the ammunition during action. In one of the Southern army corps an analogous system of supply was well and rapidly carried out last year. The men fulfilling the functions of wagon men had been permanently attached to the battalion wagons at the rate of two per battalion. The men followed the wagon in all movements, and during rapid marches mounted on the fore carriage, and prepared their distributing bags *en route*.

We are strongly of opinion then that the infantry ammunition service should be organized in peace time, and its proper working in time of action thus ensured.

One cannot lay down rules beforehand for the position of ammunition wagons on the battle-field. Foreign regulations agree in allowing considerable latitude in the matter, but all insist that the wagon should not be further removed than 800 or 1,000 mètres from the firing line, and that due regard should be paid to cover from the enemy's fire.

The wagon must follow its battalion under all circumstances, and keep as near it as possible ; that is the first point to be insisted upon.

If it is necessary to particularize further, it might be specified, without laying down an absolute rule, that the wagon should generally march with the reserve of the battalion, to which a distinct rôle has been assigned by the late introduction of volley firing at long ranges. Whilst a proportion of the companies are marching towards the enemy, the reserve, established in a favourable position, will protect the advance by volleys fired at long ranges, thus causing a considerable expenditure of ammunition. The position of the wagon then should always be near the reserve, whether it be between it and the supports, on either flank, or in its rear.

As soon as this reserve takes a direct part in the action the wagon will join the regimental reserve, excepting in such exceptional cases as may necessitate its advancing into the line of fire, such for instance as the occupation by the battalion of a defensive position.

The position of the wagon must be indicated, both by day and night, by a clearly visible signal, placed 100 or 200 mètres to a flank, so that it may not draw the enemy's fire on to the wagon.

Finally, we would again call attention to the excellent plan, adopted in all foreign armies, of establishing constant communication between the wagons and the Commandants of the various tactical units, by means of mounted orderlies.

## II. *The Supply of the Troops from the Wagon.*

It is an admitted principle never if possible to send either a man or a wagon to the rear in search of ammunition ; whenever a man or wagon leaves the actual line of fire for such a purpose, the chances are much in favour of neither of them returning during the day.

The men told off to carry cartridges should therefore be taken from the reserve from amongst those previously trained for the duty ; and, after having obtained the supply from the wagons, should advance upon the companies and replenish their ammunition in accordance with such instructions as they may receive.

We think that it is necessary to reduce the loads of these men to two bags of cartridges (336) instead of three (500). Recent experience has shown that the latter is too heavy a load (24 kilog.) to be easily carried by fatigue men in rough or boggy ground. It may be urged that by so doing we take more men from the ranks, and render the supply slower, but this can be met by taking the fatigue men from the reserves and not from the fighting line ; they could thus be renewed with impunity, and in case of emergency be retained in the fighting line, thus obtaining all the advantages due to the Austrian system of supplying the fighting line by means of the supports without incurring any of its corresponding disadvantages.

We would also urge the great utility of the Austrian system of distributing to all the companies about to enter into action an extra packet of cartridges per man, drawn from the battalion wagon. A single packet is easily stowed away, the slight additional weight would not be felt by a soldier in the excitement of going into action, and would be continually diminishing as the heat of action increased.

It is important, and should be clearly understood, that a body of men in action may, on emergency, replenish their ammunition from the nearest wagon or section.

In a prolonged engagement, or in the defence of a defined position, supplies in the shape of small depôts of ammunition can be established in convenient places. It is unadvisable, in an important engagement, to wait till the last moment to replenish ammunition, not so much for the reason that the number of cartridges carried by the soldier is likely to prove insufficient, as to allay the uneasiness engendered in his mind by the gradual emptying of his pouch. These depôts of ammunition could be drawn from the battalion carts, which thus lightened could, during the progress of the action, obtain fresh supplies from the ammunition column.

### III. *The Supply of the Battalion Carts from the Ammunition Column.*

A battalion cart must never remain empty. It should at once go and refill from the ammunition column. The loading of a wagon takes three men a quarter of an hour; this, with the time taken in going and returning, may possibly occasion too long an absence of the cart; we would suggest then that a cart once empty should proceed to the small-arms ammunition column, the horses be unharnessed, and harnessed at once into a full cart, which would thus take the place temporarily of the battalion cart. After the action there will always be time to return the carts to their various corps. In all cases the replenishing of carts should be superintended by a *sous-officier*.

In order to diminish the chances of delay in the journeys of the cart going and returning, we again repeat that it appears indispensable that a good communication should be kept up, either by means of orderlies or signalling between the troops and their carts, as also between the latter and the relieving ammunition sections. It is the only way of preventing the carts from making profitless detours.

In speaking of the arrangements for service of ammunition in the Russian Army, we have cited, amongst many other propositions brought forward by General Baron Zeddeler, that relating to the transport of ammunition from the carts to the troops engaged by means of pack animals.

In the French Army each battalion of infantry and of chasseurs has four mules loaded with pioneers' tools. Would it not be possible to relieve these mules of a portion of their load, which could be relegated to the battalion carts or baggage wagons, without sensibly increasing their draught, and be readily recovered when required, and thus leave the mules free to carry a certain proportion of ammunition?

This proportion would constitute the first reserve in action, a reserve which, added to the ammunition carried by the men, would suffice for the early stages of the action. If a probability became patent of a further supply being required, the bags or boxes could be emptied in a handy position near to the firing line, and the mules sent back rapidly to the carts.

### RÉSUMÉ.

These observations and propositions can be formulated as follows:—

- 1st. The necessity of increasing the number of cartridges at the disposal of a soldier without having recourse to the regimental reserve, and as a consequence, the necessity for adopting a new form of cartouche equipment.
- 2nd. The definite adoption of a pattern of battalion cart, that of 1850 appearing to fulfil all the necessary conditions for service.
- 3rd. The necessity of appointing during peace time a *sous-officier* for ammunition duties, as also that of selecting the conductors of the carts, exclusively from the ranks of the battalions to which they are

attached, and of exercising them constantly in peace time in their especial duties. Also the necessity of forming in each company a squad of men trained to purvey and load ammunition. In fact, to form a truly *regimental* train.

- 4th. The position of the cart to be settled with reference to the battalion and regimental reserves, and indicated by a signal placed on a flank.
- 5th. The supply of ammunition from the cart to the men engaged to be carried on, as far as possible, from the rear, and by men taken from the supports.
- 6th. Constant communication to be maintained between Commandants of battalions and regiments, and their ammunition reserve, by means of mounted orderlies especially told off to the duty.
- 7th. The establishment, in the case of defensive actions, of small depôts of ammunition in rear of the firing line.
- 8th. The immediate replenishing of every empty cart from the ammunition column, a change of vehicles being made if necessary.
- 9th. To determine whether some part of the load of the regimental mules could not, without inconvenience, be replaced by a bag or box of cartridges.

#### ENGLISH METHOD.

The following data are taken from "Papers on the Supply of Ammunition to an Army in the Field," published as a Blue Book in 1877-78.

The approved supply for a British army corps is as follows:—

					Per Rifle.
On the soldier	....	....	....	....	70 rounds.
Regimental reserve	....	....	....	....	30 "
Field reserve	{ divisional	....	....	....	40 "
	{ army corps	....	....	....	40 "
Total					180 rounds.

In addition, the depôts of Ordnance Store Department provide for 300 rounds per rifle.

*The 70 rounds carried on the soldier.*—The great necessity of separating ammunition from kit is fully recognized in the British Army, and although the best form of equipment for the infantry soldier is still a matter of experiment, it is certain that this fact will not be lost sight of.

*The Divisional Field Reserve Column* will be in charge of the artillery, and consists of fifty-five carriages, including twenty-nine carts for small-arm ammunition. These columns would have to be organized in "war time"; the carriages are in store at Woolwich, but the *cadres* of Officers, non-commissioned officers, men, and horses have no definite existence.

*The Army Corps Reserves.*—The same remark applies to the army corps reserve columns, which are designed to consist of three sections of thirty-five carriages each, carrying the whole of their ammunition in general service wagons, twelve of which in each section are devoted to the transport of small-arm ammunition. More especial details of these columns will be found in Clause 108, Army Circulars, 1875.

*The regimental reserve of 30 rounds* is carried in three two-wheeled carts of special construction, drawn by two horses. Each cart carries 9,600 rounds, packed in sixteen boxes of 600 rounds each.

The carts, as far as experience has gone, are fairly well adapted for their purpose, but the number (3) attached to a battalion seems undesirable, as in

no way corresponding to any tactical division. When it is considered that the regimental reserve comes more particularly into play when units are detached and hard pressed, it would appear that four carts, or one per double company, would be a more desirable detail, although in excess of what is required for actual storage.

A pack equipment is also kept in store, each pack-saddle carrying two boxes of 600 rounds. Twenty-four mules or pack-horses would therefore be required for the carriage of the 28,800 rounds constituting the regimental reserve.

Although it is intended that the regimental reserve shall be entirely under the control of regimental Officers, no *cadre* for the purpose is at present maintained in the regiments of our Service, and no regulations exist for the maintenance of communication between the regimental reserve of ammunition and the fighting line. A regiment, indeed, rarely sees, still less practises with, an ammunition cart.

Recent events would seem to point to this as being a grave defect in our organization. If report be true, the first attack on Ali Musjid saw troops in action bereft of cartridges, and Isandlwana furnishes a sad instance of brave men dying, their pouches empty, within sight of their reserve ammunition.

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MARCH OF THE TURKESTAN DETACHMENT ACROSS THE  
DESERT, FROM THE AMU DARYA (OXUS) TO THE AKHAL  
TEKKE OASIS, DURING SKOBELLEFF'S CAMPAIGN AGAINST  
THE TEKKE TURKMANS, 1880.

Translated from the Russian by Lieutenant J. J. LEVERSON, R.E.

Contributed by the Intelligence Branch of the Quartermaster-General's  
Department.

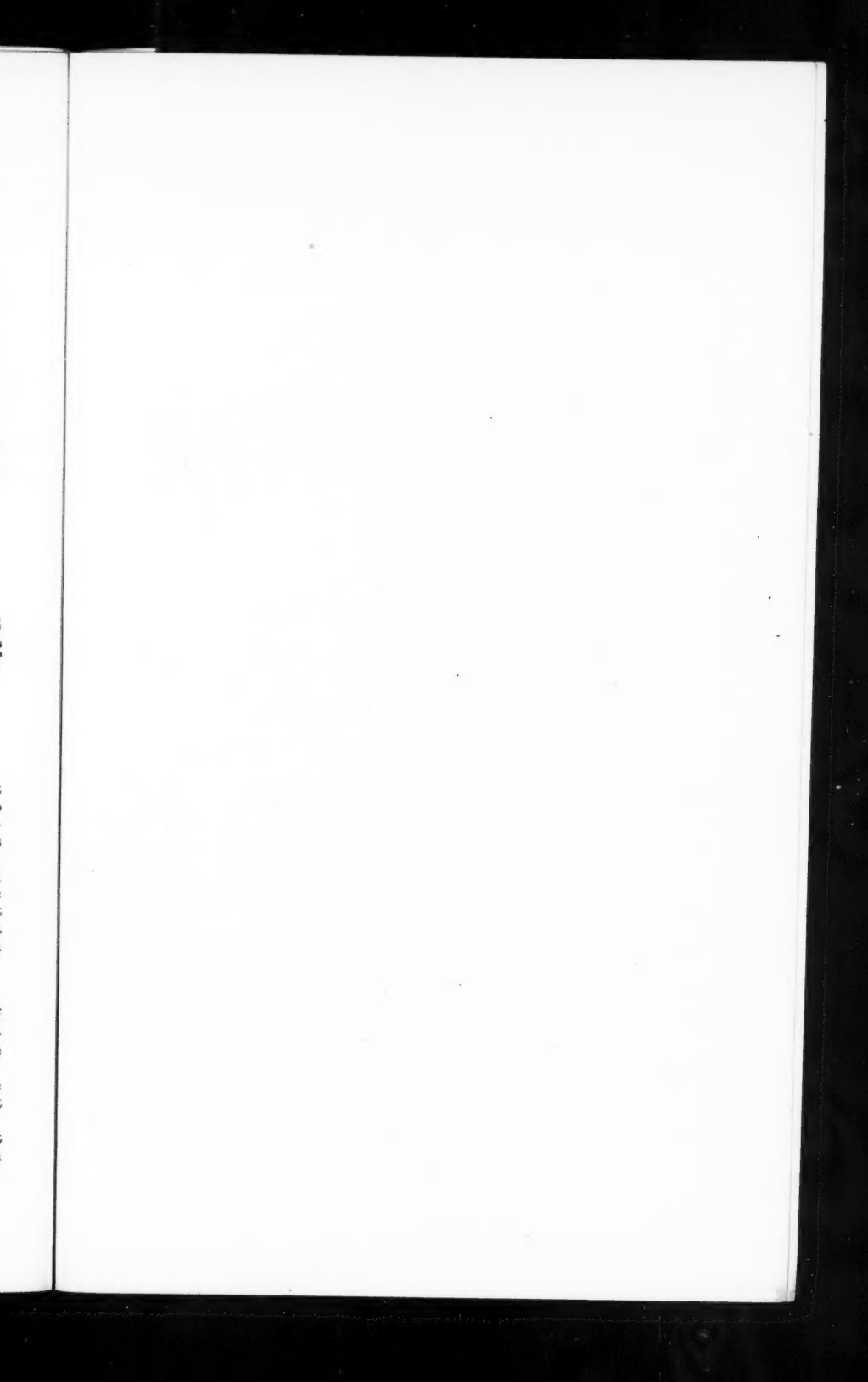
THE following pages contain an account of the march made by a detachment of troops belonging to the army of Turkestan from the Khanate of Khiva to the Akhal Tekké oasis, to assist General Skobeleff against the Tekké Turkmans. The campaign resulted in the capture of Denghil Tépé, and its annexation to Russia.

The narrative is written by Captain Muravtseff, Staff Officer to Colonel Kuropatkin, Commandant of the detachment. It was published in the number for March, 1882, of the "Russian Military Journal," and gives most interesting details of the preparations and dispositions for the march, and a careful description of the route. The translation has been slightly curtailed in a few places to avoid unnecessary repetition.

Captain Muravtseff continues his narrative of the doings of the Turkestan detachment, up to the capture of Denghil Tépé on the 24th January, 1881, but the translation has not been carried beyond the date of the arrival of the detachment at Bami, when it became an integral part of General Skobeleff's force. A general description of the siege and assault of Denghil Tépé has already been published by the War Office.

The special features of the march were the necessity of carrying large quantities of water and forage, and the difficulty of marching through drift sand.

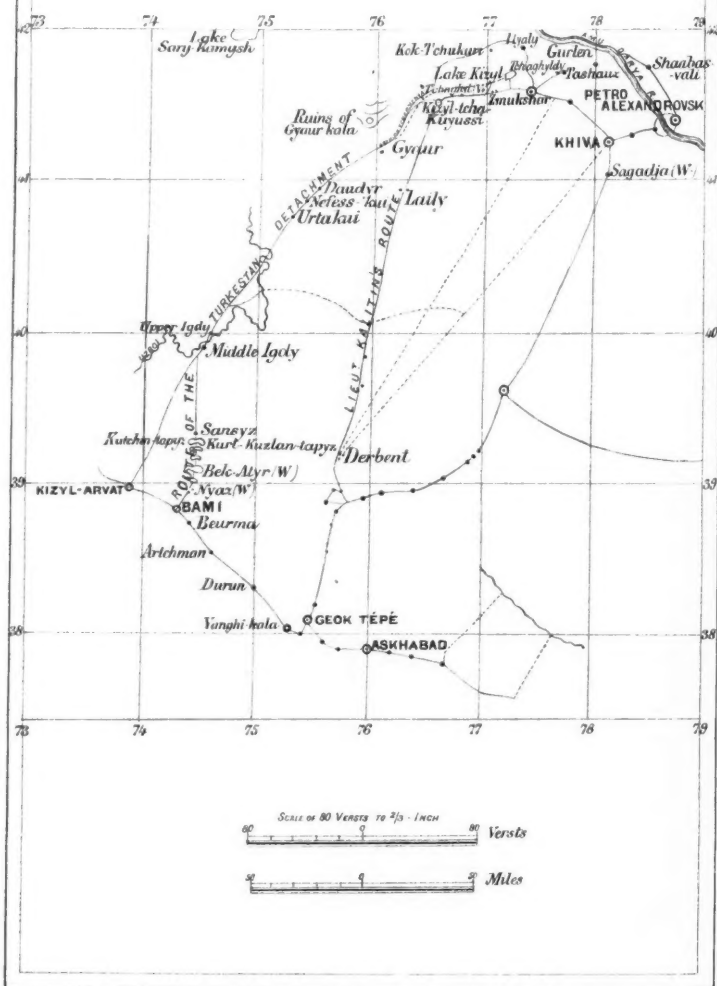
As General Skobeleff was anxious to secure the services of the detachment as soon as possible, the march was accelerated by carrying the infantry on



# SKETCH

of the route followed by the Turkestan Detachment,  
and of the routes between the Khivan & Tekke  
oases

Compiled from the reports and reconnaissances of  
**LIEUT KALITIN.**



camels for a great part of the distance. Many of the marches were extremely long, as will be seen on reference to the itinerary<sup>1</sup> I have compiled. On one occasion the troops marched all night; and frequently did not halt till many hours after darkness had set in, for the journey was made in the short days of mid-winter. In the summer it would have been next to impossible to cross the desert, the routes being only passable in the early spring or winter, when the sand is more compact, owing to damp and cold.

The health of the detachment appears to have been excellent, and the expenditure of camels small, considering the few opportunities of watering them. After leaving Gyaur-Kala on the 7th December they were only watered twice before reaching Bami on the 20th. The distances traversed during this time were:—from Gyaur-Kala to Urtakui 86 miles, from the latter place to Igdy 69 miles, and thence to Bami 108 miles. The total distance from Petro-Alexandrovsk to Bami was about 450 miles. The march occupied twenty-seven days, inclusive of one employed in crossing the Amu Darya, and seven days on which the detachment remained halted to complete the organization of its train, dig wells, &c.

All the distances and measures have been converted into their English equivalents.

J. J. LEVERSON, *Lieut., R.E.*

10. 5. 82.

Towards the end of October, 1880, it was decided to send a detachment of the troops occupying the district of the Amu Darya (Oxus) to assist Adjutant-General Skobeleff, commanding the troops in the Trans-Caspian province, in his operations against the Tekké Turkmen.

In Turkestan<sup>2</sup> General Order No. 38 of the  $\frac{1}{2}$ th October, 1880, a detachment, to be called *the Turkestan Detachment*, was detailed as follows:—

2 companies and 2 sotnias<sup>3</sup> from the garrison of the fortress of Petro-Alexandrovsk,<sup>4</sup> and 1 company from the Sary-Kamysh<sup>5</sup> detachment, which was covering the work of the scientific expedition exploring the dry bed of the Amu Darya.

Colonel Kuropatkin, commanding the brigade of rifles of Turkestan, was appointed to the command of the detachment, and was given the powers of a General of Division. His Staff was composed as follows:—

Adjutant of the detachment—Captain Muravtseff, senior Adjutant of the brigade of rifles of Turkestan.

Orderly Officers—Yessaul<sup>6</sup> Nudjevsky, of the 1st Regiment of Cossacks of Siberia, and Lieutenant Kalitin, of the 1st Battalion of Rifles of Turkestan.

Interpreter—Sub-Lieutenant Yenikyeff, of the 2nd Battalion of Rifles of Turkestan.

Transport Officer—Sub-Lieutenant Susanin, of the 4th Battalion of Rifles of Turkestan.

Surgeons—Surgeon Volkoff, attached to the Military Hospital of Samarkand, and another to be detailed from the garrison of Petro-Alexandrovsk; and

<sup>1</sup> *Vide* Appendix.

<sup>2</sup> The troops in the district of the Amu Darya are under the orders of the Governor-General of Turkestan.—J. J. L.

<sup>3</sup> Cossack squadrons.—J. J. L.

<sup>4</sup> On the Amu Darya.—J. J. L.

<sup>5</sup> A salt lake through which the Amu Darya probably ran in ancient times.—J. J. L.

<sup>6</sup> Captain of Cossacks.—J. J. L.

Extra Staff Officer—Lieutenant Yagodkin of the 3rd Battalion of Rifles of Turkestan.

In consequence of this appointment, Colonel Kuropatkin, and the Officers of his staff, most of whom had been recalled from Kuldja, started on the 20th October, 1st November, by post from Tashkent for Djizak.<sup>1</sup> They left the latter place on horseback on the 24th October, 5th November, and after travelling 426 miles along the route followed by the Turkestan column<sup>2</sup> in the expedition to Khiva in 1873, Petro-Alexandrovsk was reached on the 8th November. On the 10th 2nd the Turkestan detachment was definitely organized, and Colonel Kuropatkin assumed command of it.

On the suggestion of Colonel Kuropatkin, the strength of the detachment was increased by two mountain guns and a rocket section with two rocket troughs from the 1st Regiment of Cossacks of Orenburg. The object of these additions was to make the detachment more complete, as there were rumours of the appearance of large bodies of Turkmans on the route selected for the march from the Amu Darya to the Tekké oasis.

The train of the detachment consisted of 900 camels, which were detailed as follows:—

For the Infantry .....	455
” Artillery .....	52
” Cossacks .....	294
” Staff .....	60 <sup>3</sup>
” Hospital .....	18
” Train and spare .....	21

The infantry were to ride on camels. Each camel carried two men, and, besides this, some felt rugs.

Major Yefremoff was appointed commandant of the train. He had been previously attached for special service to the staff of the commandant of the district of the Amu Darya.

Surgeon Bentovsky, of the 1st infantry regiment of the Cossacks of Orenburg, was appointed senior Surgeon of the detachment.

At 11 A.M. on the 12th November, the Turkestan detachment set out from Petro-Alexandrovsk. Its strength was as follows:—

The 1st company of the 13th Turkestan frontier battalion—3 Officers, 18 non-commissioned officers, 22 musicians, 121 rank and file, and 10 non-combatants.

The 3rd company of the 5th Turkestan frontier battalion—4 Officers, 14 non-commissioned officers, 2 buglers, 126 rank and file, and 8 non-combatants.

The 3rd division of the 4th battery of the 1st brigade of artillery of Turkestan—1 Officer, 1 non-commissioned officer, 29 gunners, 5 non-combatants, and 14 horses.

The 1st sotnia of the 1st cavalry regiment of Cossacks of Orenburg—1 Field Officer, 5 regimental Officers, 1 Tchinovink,<sup>4</sup> 19 non-commissioned officers, 3 trumpeters, 114 Cossacks, and 5 non-combatants.

A rocket section of the last-mentioned regiment—1 Officer and 22 non-commissioned officers and men.

The 5th sotnia of the 2nd cavalry regiment of the Ural Cossacks—2 Field Officers, 3 regimental Officers, 17 non-commissioned officers, 3 trumpeters, 116 Cossacks, and 5 non-combatants.

<sup>1</sup> An important town between Tashkent and Samarcand guarding the gates of Tamerlane on the north.—J. J. L.

<sup>2</sup> General Golovatcheff's column.—J. J. L.

<sup>3</sup> Inclusive of those for the escort, the Djighits (native scouts), and guides.

<sup>4</sup> An official holding rank.—J. J. L.

The two companies under Captain Bogayevsky, who had been appointed to the command of the infantry of the detachment, and the artillery, under Staff-Captain Grek, made a march of  $11\frac{1}{3}$  miles from Petro-Alexandrovsk, and halted for the night at a Cossack settlement.

The division of Cossacks and the rocket section, under the command of Lieutenant-Colonel Gulyaëff of the Ural Cossacks, as well as Colonel Kuropatkin and his staff, slept at Shabaz-vali, 20 miles from Petro-Alexandrovsk.

The whole of the camel train belonging to the Cossacks, and the greater part of that of the infantry, reached Shabaz-vali on the first day, arriving there about 10 P.M.

On the  $1\frac{1}{2}$ th November, the infantry and artillery, as well as the rest of the train, reached Shabaz-vali at 8 A.M., and proceeded immediately through Bi-bazar to the Gurlenskaya ferry, at which the Amu Darya was to be crossed. The ferry is so called as it is near the town of Gurlen, situated  $4\frac{2}{3}$  miles from the river, on its left bank.

The Cossacks started from Shabaz-vali for the ferry about 5 A.M., making a march of  $20\frac{2}{3}$  miles. The infantry marched  $29\frac{1}{3}$  miles that day.

By three o'clock in the afternoon, both the sotnias and the rocket section had crossed to the left bank of the Amu Darya. The baggage was the next to be ferried across, but at first the work progressed very slowly, as only four boats were available, each capable of carrying from ten to fifteen camels at a time. The operations were continued uninterruptedly during the night. By the morning of the  $\frac{3}{4}$ th November, the number of boats had increased to ten, and during the day the remainder of the detachment was carried across.

$\frac{1}{2}$ th November.—The detachment advanced from the ferry to Sheikh-kala, in the *aryk*<sup>1</sup> of Yarmysh, a distance of 30 miles. The order of march was as follows:—The cavalry in front, preceded by an advance guard; next came the train, that of the cavalry first, and then that of the infantry. The companies of infantry followed, and last of all there was a rear-guard of infantry. All the non-commissioned officers and men of the frontier battalions rode on camels, two on each camel. The detachment reached the halting place at 6 P.M., having started at 6 A.M.

In the evening a small train arrived from Petro-Alexandrovsk with warm clothing, and other necessities for the troops.

$\frac{1}{2}$ th November.—Six miles beyond the bivouac the detachment reached the town of Tashauz. Outside the gates it was met by the inhabitants, bearing presents of cakes, grapes, and pistachio nuts.

After a further march of  $5\frac{1}{3}$  miles, the stream of Daryalik was reached. The troops were carried across in wagons, which had brought reeds for fuel.

The infantry marched on foot from Sheikh-kala to the Daryalik. Beyond that they rode on camels, the road being across sand till close to Khodja-Kumbet, where the detachment halted for the night. Length of march,  $23\frac{1}{3}$  miles.

$\frac{1}{2}$ th November.—The combatant units of the detachment started alone, the cavalry at 6 A.M., the infantry at 7 A.M. As regards the train, Colonel Kuropatkin ordered Major Yefremoff to pick out all the weak camels, and turn them out to graze. He was to allow them to feed till 11 A.M., then load, and follow the detachment to Tchaghyl.  $5\frac{1}{3}$  miles beyond Khodja-Kumbet the road passes close to the ruins of the ancient fortress of Izmukskir. The detachment reached the wells of Tchaghyl about three in the afternoon.

Length of the march to Tchaghyl,  $18\frac{2}{3}$  miles.

A sotnia of Cossacks of Orenburg, and half a sotnia of Ural Cossacks, forming part of the Sary-Kamysh detachment, were already encamped there. Colonel Krabbé, commanding this detachment, and Major-General Glukhovsky, chief of the scientific expedition for the exploration of the

<sup>1</sup> A dry river bed.—J. J. L.

old bed of the Amu Darya, arrived in the afternoon. In the evening a company of the Sary-Kamysh detachment—the rifle company of the 13th frontier battalion of Turkestan—marched in, and on the following day, the 18th November, agreeably to Turkestan General Order No. 38, joined the Turkestan detachment, increasing it by 3 Officers and 150 non-commissioned officers and men.

It appeared probable that the water in the wells of Tchaghyl (five in number) would be very quickly exhausted by so large a number of men and horses. Consequently, Colonel Kuropatkin, having previously ascertained that there was a large fresh-water lake 4 miles from the road, sent thither the division of Cossacks of the Turkestan detachment on the 17th November. The Cossacks took with them forage from the store of the Sary-Kamysh detachment at Tchaghyl. The rest of the Turkestan detachment—the infantry and artillery, as well as 1½ sotnias of the Sary-Kamysh detachment, remained at Tchaghyl, and spent the whole of the following day there.

18th November.—Khorunji<sup>1</sup> Stetsenko, of the Taman regiment of Cossacks of the Kuban, reached Tchaghyl. He had been sent by Adjutant-General Skobelev to explore the route across the desert, and to meet the Turkestan detachment, and be its guide to the Akhal-Tekké oasis.

He presented the following report to Colonel Kuropatkin, containing an account of his journey from Kizyl Arvat to Petro-Alexandrovsk, completed in 10 days :—

“H. E. Adjutant-General Skobelev, commanding the troops in the Trans-Caspian district, having called for a volunteer to proceed from Kizyl Arvat across the desert to Khiva, make sketches of the route, measure the wells, make notes of the fuel and pasturage, present his route report to you, and deliver to you a packet of despatches, I offered myself for the service. On the 31st October, after receiving the despatches from Adjutant-General Skobelev, I rode out of the fort of Dhuz Olum<sup>2</sup> at midnight, with four guides and eight horses. Proceeding slowly, so as not to exhaust the horses, I reached Kizyl Arvat at 9 p.m. on the 1st November. I rested there for a day, provided myself with apparatus for carrying water, with oats, and two sheep; and at 2 a.m. on the 4th November set out in a north-easterly direction, the road being over muddy and clayey soil. At 8 a.m., I reached the wells of Arshikui, and found them choked up. After resting for three hours, I continued the march, and on the road to the wells of Igdy saw an encampment of nomad Tekkés with their flocks and camels. After passing round the encampment, I halted for the night, as it was dark and cloudy, and I was at a spot where there was some pasturage, in the shape of shrubs, occasionally found on the road from the wells of Arshikui to those of Akjaili.

“Next day, the 5th November, I reached the wells of Puran at 9 a.m., and found them filled up. I proceeded northwards without halting, and 12 miles further on came to the wells of Kizyl-Takyr. They are three in number, but the water was very musty and brackish. In one it was less saline than in the others, but this one only contained 7 gallons, and half of that was mud. I had to give each horse 2½ gallons out of the skins. Not more than 2½ gallons remained for myself and the guides. I halted for three hours, and then continued the march in the same direction as before. Having marched till 11 p.m., occasionally leading the horses by the bridle, I reached the dry bed of the Uzboi, and halted for the night. We rose at 2 a.m. on the 6th November, and left one guide with the three led horses at the bivouac, whilst I and the other three guides went in search of the road. We did not discover

<sup>1</sup> Cornet of Cossacks.—J. J. L.

<sup>2</sup> A fort on the Sumbar on the road between Tchikishlyar and Kizil Arvat.—J. J. L.

it till 10 A.M. After resting two hours we set out in a north-easterly direction. Having proceeded  $22\frac{3}{4}$  miles through deep sand, in which the horses could hardly walk, and had to be led by the bridle, I reached the wells of Upper Igdy. It had been necessary to throw away part of the barley and meat. The water in the wells was brackish and musty, and not good for horses to drink. Having watered the horses, however, I continued 10 miles further in a north-westerly direction along the dry bed of the Uzboi, and then halted for the night. On the  $\frac{7}{9}$ th November, I rose at 3 A.M., and proceeded to the wells of Akjaili,  $25\frac{3}{4}$  miles from those of Igdy.

"The wells were choked up, and therefore, without halting, I continued on foot in the same direction along the bed of the Uzboi. The oats had been partly eaten up, and partly thrown away on the previous day, and the horses were so exhausted through hunger and thirst, that they could not carry us. Driving them before us, and halting occasionally to rest, we marched till 11 P.M., after which I turned to the north-east, as if towards Sary-Kamysh. After proceeding three hours in this direction, my guides positively refused to lead me any further. I continued, however, to advance on foot through the fine sand without changing direction, and at 8 A.M. on the  $\frac{8}{10}$ th November reached a ruined hut and some wells. One of the latter was filled up, but another contained fresh water  $6\frac{1}{2}$  feet deep. After drinking, and watering the horses, we rested till 2 P.M. The guides did not know the name of the wells. At 2 P.M., we started again in a northerly direction, and continued, with occasional short halts, till 5 A.M. on the  $\frac{9}{10}$ th November, when we unexpectedly met the 3rd company of the 13th Frontier Battalion, belonging to General Glukhovsky's detachment. The company was halting on the road from Tcharyshly to the wells of Urtakui. On learning the condition that I and my companions were in, Lieutenant Yartchevsky, who was in command of the company, provided us with everything we required. He informed me that I was not on the road to Sary-Kamysh, that the last wells I had passed were those of Urtakui, and pointed out to me the route to the wells of Tcharyshly, where General Glukhovsky's detachment was stationed. After resting three hours, I set out again, and on reaching Tcharyshly presented myself to General Glukhovsky. I learned from him that you were shortly expected at Petro-Alexandrovsk. On the morning of the  $\frac{10}{20}$ th November, I started in the direction of Petro-Alexandrovsk, and reached the wells of Kizyltecha-Kuyussy on the  $\frac{1}{2}$ th. I heard there that you were at Petro-Alexandrovsk, where you were expected to remain till the  $\frac{20}{20}$ th November. Having got rid of my horses, as they were quite worn out, and having handed over my guides to the commander of the rifle company of the 13th Frontier Battalion, I started again for Petro-Alexandrovsk on fresh horses, and arrived there on the evening of the  $\frac{1}{2}$ th November.

"I then learned that you and the detachment had already left on the  $\frac{1}{2}$ th in the direction of the wells of Urtakui. Having received two horses and two guides from Lieutenant-Colonel Pyevstov (who had been left in charge of Colonel Grotenhelm's detachment), I set out again on the  $\frac{1}{2}$ th November, and overtook the Turkestan detachment on the  $\frac{1}{2}$ th, at the wells of Tchaghyl. I immediately handed to you the despatches of which I was the bearer, and annex to this report the route sketch which I made from Kizyl Arvat to Gyaurl-Kala, with details of the quality and quantity of the water in the wells, and of the pasturage and fuel along the route."<sup>1</sup>

Whilst apparatus for carrying water was being collected, and the unser-

<sup>1</sup> General Skobelev considered the task entrusted by him to Khorunji Stetsenko so important, that he requested the commandant of the troops in the district of the Amu Darya, in the event of its fulfilment, to recommend Stetsenko for the Cross of St. George of the 4th Class.

viceable camels were being replaced by fresh ones, a halt had to be made. In consequence of the insufficiency of water in the wells, and the inconvenience of having to drive the camels and horses 4 miles to water, it was decided to transfer the rest of the Turkestan detachment to the lake, where the Turkestan Cossacks were already encamped.

On the <sup>19th November,</sup><sub>1st December,</sub> the three companies of infantry, the artillery, and the detachment staff quitted Tchaghyl, and proceeded to the lake of Kizyl-Tchaghyldy. The troops camped in a square, two sides of which were formed by the infantry and artillery, a third by the Cossacks, and the fourth by the lake.

On the <sup>20th November,</sup><sub>2nd December,</sub> a third day's halt was made to give the troops time to mend the skins, soak the barrels and fill them. The apparatus for carrying water, collected, thanks to the co-operation of Colonel Grotenhelm, who had accompanied the detachment from Petro-Alexandrovsk, was taken partly from the Sary-Kamysh detachment, and partly supplied by the Khivan authorities. It consisted of 231 barrels and 484 skins. The mean capacity of the barrels was  $21\frac{1}{2}$  gallons, and of the skins 8 gallons. They were distributed at follows:—

To the three companies of infantry—474 Officers and men, and 22 horses; 125 barrels and 41 skins.

To the two sotnias and rocket section—314 Officers and men, and 336 horses; 79 barrels and 384 skins.

To the artillery—36 Officers and men, and 14 horses; 10 barrels and 16 skins.

To the staff (including the natives attached to it), and in reserve—15 barrels and 18 skins.

To the hospital—2 barrels.

To Major Yefremoff, commanding the train, for the *Lautes* (drivers)—25 skins.

Thus by the <sup>20th November,</sup><sub>2nd December,</sub> the detachment was provided with all necessaries, and was prepared to advance boldly into the desert. The supplies carried on leaving the lake were as follows:—Forage (barley) for the sotnias and artillery for 21 days; provisions<sup>1</sup> for the whole detachment for 30 days, 17 bullocks and 221 sheep, besides which two meat contractors accompanied the detachment, a four-months' supply of tea and sugar, and considerable quantities of essence of vinegar and dried cabbage; and for the camels, compressed *sesamé* (*kunjura*).

The equipment of the detachment was very ample, the troops being supplied with felt rugs (some of them with yurts<sup>2</sup>) sheep-skin cloaks, wadded shirts, felts to sleep upon, broad-soled boots, and new uniform.

The 900 camels detailed by the Officer commanding the troops of the district (Turkestan) were barely sufficient to carry the infantry, as well as the large quantity of stores. The three companies and two sotnias became, as it were, merely an escort, and were almost lost in the huge train of dromedaries and camels, without which it is impossible to travel in the desert. The train, however, enabled Colonel Kuropatkin to fulfil his main object—to reinforce General Skobelev by a large number of men and horses, and hand them over in good health and ready for action. The route to be followed by the detachment was very little known, even as far as the wells of Urtakui. One company of the Sary-Kamysh detachment had been to them, but no reports or sketches had been made. The Officers of the company, however, gave verbal descriptions of the road to Colonel Kuropatkin, and he derived further information from the Turkmans.

<sup>1</sup> This probably refers to bread-stuffs only.—J. J. L.

<sup>2</sup> Turkman tents.—J. J. L.

Till a few days before the arrival of the Turkestan detachment at Tchaghyl, the Sary-Kamysh detachment had occupied the wells of Tchaghyl, Kizyl-tcha-Kuyussi, and Gyaur, *i.e.*, the route of the Turkestan detachment, for 66 miles; but the wells of Gyaur had been subsequently abandoned. It was feared that after the *départure* of our troops, bands of Tekkés might fill up these wells, which had been sunk with great difficulty. Major-General Glukhovsky kindly offered to re-occupy them with a detachment of Cossacks, not exceeding 25 men. A larger number would have consumed too much of the water, so very precious in the desert.

On the following day General Glukhovsky made another proposition, *viz.*, instead of sending a detachment to Gyaur, to send it on to Urtakui to clean out the wells at the latter place for the Turkestan detachment. He did not, however, consider 25 Cossacks a large enough body to send so far, Urtakui being 133 miles from Tchaghyl, where the Sary-Kamysh detachment was encamped.

There was really no necessity for the occupation of Urtakui, as water is found very near the surface there, and clearing out old wells, or sinking new ones, only takes a short while. As a matter of fact, when the Turkestan detachment reached Urtakui, in addition to one well found in good order, and another cleaned out by the Sary-Kamysh Cossacks, the troops cleared out or sank eight wells.

On departure from the Lake Tchaghyldy, the strength of the Turkestan detachment was as follows:—

	Field Officers.	Regimental Officers.	Tchinovniks.	Musicians and trumpeters.	N.C. officers.	Privates and Cossacks.	Non-combatants.	Officers' servants.	Total.
Staff .....	2	6	2	..	2	6	1	4	23
Infantry .....	..	12	..	26	48	367	12	7	472
5th sotnia of the 2nd Regiment of Ural Cossacks ..	2	4	..	3	10	128	1	..	148
1st sotnia of the Orenburg Regiment .....	1	5	1	3	15	114	5	..	144
Rocket section .....	..	2	..	..	2	22	..	..	26
Mountain Artillery .....	..	1	..	..	..	35	..	..	36

Total—5 field Officers, 30 regimental Officers, 3 tchinovniks, 77 non-commissioned officers, 32 musicians and trumpeters, 672 rank and file, and 30 non-combatants and Officers' servants, making a grand total of 849, with 2 guns, and 2 rocket troughs.

The natives accompanying the detachment were as follows:—4 guides, 15 djighits, and 153 lautches<sup>1</sup> for the 900 camels.

The camels were told off as follows:—to the infantry 465, to the staff and natives 60, to the Cossacks 300, to the artillery 50, to the hospital 18, and to Major Yefremoff 4, leaving 3 spare ones.

After leaving Lake Tchaghyldy, the detachment moved in two *échelons*, the first consisting of the cavalry and rocket section with their trains, and the second of the infantry and artillery with their trains.

<sup>1</sup> Native drivers.—J. J. L.

The 1st échelon was under the command of Lieutenant-Colonel Gulyaëff, the 2nd of Captain Bogaevsky.

The 2nd échelon was to start from Lake Kizyl Tchaghyldy a day later than the 1st, and was always to remain one march behind it, till the issue of fresh instructions.

The division of the column into two échelons was made in anticipation of a scarcity of water in the wells of Shakh-Senem and Gyaour-Kala. Besides which, at Kizyl-tcha-Kuyussi, through which the road passed, there was good water in one well only. This would not suffice for the whole detachment, and it would have been a great risk to expend the water carried from Lake Kizyl Tchaghyldy at the commencement of the march, not knowing what might happen further on.

At 9 A.M. on the <sup>21st November,</sup><sub>3rd December,</sub> the cavalry and staff quitted the camp at Lake Kizyl Tchaghyldy. The train of the 1st échelon had already started at 8 A.M. The sotnias marched at an average rate of  $4\frac{1}{2}$  miles an hour. They made three halts of about one hour each, and arrived at the wells of Kizyl-tcha-Kuyussi about 9 P.M. The distance traversed was about 40 miles. The road was partly through sand, partly over hard clay-flats called *takyr*s. The rain that had fallen two days previously had formed large pools on the *takyr*s, and had washed away so much of the road that the camel-train could not march at night, and had to halt before reaching Kizyl-tcha-Kuyussi.

The train of the 1st échelon did not arrive at Kizyl-tcha-Kuyussi till 3 P.M. on the <sup>22nd November</sup><sub>4th December</sub>. In consequence of this, the march of the échelon to Shakh-Senem was postponed till the following day.

Thanks to the rain, the pools on the *takyr*s sufficed to water, not only all the horses, but also all the camels; and the reserve of water carried by the troops was left untouched.

<sup>23rd November</sup><sub>5th December</sub>.—The train, escorted by a section of Cossacks, started at 8 A.M.; the sotnias and the chief of the detachment and his staff at 9 A.M. After the 17th mile a loamy ground is reached, suitable for the movement of troops of all arms. The *aryk* of Tchermeniab runs parallel to the road. At the 10th mile from the wells of Kizyl-tcha-Kuyussi a chain of low hills is crossed.

At 3 P.M. the detachment halted for the night at the wells of Shakh-Senem, two-thirds of a mile from the ruins of the fortress of that name.

The original intention was to proceed from six to eight miles beyond Shakh-Senem, and halt at some *krakos* (pits filled with rain water). But the djighits sent on in advance to explore reported that there was no water in them. It was therefore decided to halt at Shakh-Senem, taking advantage of the opportunity to water the camels in the pools of the *takyr*s, which were numerous in the vicinity of the wells.

There are two wells at Shakh-Senem. In one the water is not good, but can be drunk in case of necessity, in the other it is bitter and brackish and quite unfit for drinking purposes.

<sup>24th November</sup><sub>6th December</sub>.—The train of the 1st échelon started at 7.30 A.M., escorted by half the sotnia of Cossacks of Orenburg, and reached the wells of Gyaour-Kala at 4 P.M. The camels marched in three files. The sotnias and the chief of the detachment started at 8 A.M., and arrived at 2 P.M.

The road was principally over sandy ground overgrown with *saksaul*.<sup>1</sup> At the 6th and 12th miles large clay-flats (*takyr*s) were passed. They contained pools of rain water. At the 14th mile there is a large isolated hill to the right of the road. At the 17th mile a range of heights approaches within two miles of the road to the west, and runs from north to south. On the southern end of this range stand the ruins of the fortress of Gyaour-Kala. The *aryk* of Tchermeniab quits the road, and goes off in the direction of these

<sup>1</sup> A desert plant.—J. J. L.

ruins. There are two wells, from 49 to 56 feet deep, at the camping ground. They contained only from 400 to 450 gallons of slightly brackish water. Fodder and fuel had to be collected along the road, there being none near the wells.

There were 11 Cossacks and 1 Officer of the Sary-Kamysh detachment in the fort of Gyaur-Kala. They returned to Kizyl-tcha-Kuyussi after the passage of the two échelons of the Turkestan detachment.

The distance from Shakh-Senem to Gyaur-Kala is 20 miles. Besides the two wells at the latter place, there was a large pit containing rain water. On inspecting and testing the water-carrying apparatus of the 1st échelon, it was discovered that owing to leakage and negligence, the Orenburg sotnia had only 594 gallons of water left, and the Ural sotnia 945 gallons.

In anticipation of the waterless marches to the wells of Urtakui, orders were given to fill up all the skins and barrels. When all were filled the Orenburg sotnia had 1,375 gallons, the Ural sotnia 1,415 gallons. The water was taken from the rain-water pit. In a well dug by the Sary-Kamysh detachment, only an inconsiderable quantity of water was found.

On the morning of the <sup>26th November,</sup><sub>8th December,</sub> before the departure of the 1st échelon, a report of the movements of the 2nd échelon was received from Captain Bogaevsky. It stated that the 2nd échelon had reached Gyaur-Kala without accident on the <sup>25th November</sup><sub>7th December</sub>. The camels, with few exceptions, had marched well. Three had died, and five weak ones had been abandoned. The marches had varied in length from 16 to 28 miles. Both the Officers and men were well. On departure from Gyaur-Kala it was proposed to issue a ration of 1½ lbs. of meat per man. The live stock of the companies was marching satisfactorily. It was intended to divide the distance from Gyaur-Kala to Urtakui into three marches, and not to start before 10 in the mornings, so as to give the camels time to feed. The store of water had remained untouched, except 280 gallons which had leaked out; and had been replaced at Gyaur-Kala. The total amount of water to be carried was 3,210 gallons by the infantry and 350 gallons by the artillery, a quantity which would suffice for five days. The échelon marched in the following order:—First, a section of infantry as an advanced guard, with an advanced patrol of 3 Cossacks, then 2 sections of infantry, and the artillery; and after them 3 sections of infantry. Four sections of infantry escorted the camel train. Half a company formed the rear-guard, with 3 Cossacks in rear of it, and 4 as flanking patrols.

<sup>25th November</sup><sub>7th December</sub>.—The train of the first échelon started from Gyaur-Kala at 7 A.M., and the sotnias at 8 A.M. Having marched 20 miles, at 6 P.M. they halted for four hours at a place without water. Water for the men and horses was served out from the skins and barrels. The camels fed on *kunjura*. The head of the train moved off again at 10 P.M., and the tail was clear of the halting-place at 11 P.M. The sotnias then followed. As the night was very dark, the camels were loaded by the light of piles of burning wood. An advanced guard of a quarter of a sotnia preceded the train, and after proceeding a few miles, halted and collected piles of wood. The head of the column, on reaching the advanced guard, halted to allow all the camels to close up. After this, the advanced guard, the Ural sotnia, and the rocket section went on in front, the train, escorted by the Orenburg sotnia, following them.

The march was continued in this order till 2 A.M. The night was exceedingly dark. The road lay through an open country, principally over hard and stony ground. The road was a mere track, difficult to recognize even by daylight. At 2 A.M. the Ural sotnia, which was preceding the train, was ordered to leave posts of 4 Cossacks each along the road every half-hour. These posts were to keep fires burning till the arrival of the train, and then join the Orenburg sotnia. At 6 A.M. on the <sup>26th November</sup><sub>8th December</sub> the column halted for the second

time at a place without water, having marched  $18\frac{2}{3}$  miles during the night. The total distance from the last camping place was  $38\frac{2}{3}$  miles. From Gyaur-Kala to the heights of Zanga the road is through sand, and beyond that the ground is stony. Between the 18th and 24th miles the sands reappear, and thence to the end of the march the road was again stony. In the 5th mile the road crosses a river-bed, which runs parallel to it for 20 miles, and then turns off to the west towards Tchirishly. At the 13th mile the road crosses the heights of Zanga. Their ascent and descent is practicable for trains of any kind. On the heights, Mullushka was plainly visible about  $1\frac{1}{2}$  miles to the right of the road. At the 15th mile two heights were visible to the west of the road, the higher one 8 miles off, the lower one  $3\frac{1}{2}$  miles. The more distant one is called Zanghi-baba. After this a hollow runs parallel to the road for  $2\frac{2}{3}$  miles. In the 28th mile there is an old abandoned well. Report says that it was dug to a depth of 700 feet without finding water.

The head of the train reached the halting-place at 9 A.M., but the last of the camels did not arrive till 2 P.M. The camels which had arrived latest were to halt and feed for two hours. A special escort of Cossacks was told off to them. The rest of the train started again at 2 P.M., and the sotnias at 3 P.M. On the

26th November  
28th November  
the order of march was similar to what it had been on the preceding day. After dark piles of wood were lighted along the road.

After proceeding 12 miles ( $50\frac{2}{3}$  from Gyaur-Kala) two wells were discovered at Daudyr. The road to them was stony and sandy, further on it was through sand. In one of the wells the water was slightly brackish, but fit for drinking purposes; in the others it was somewhat bitter. The horses drank freely. The sotnias only stopped at the wells the time necessary to water the horses. The train went on without halting.

Seven miles beyond the wells of Daudyr there is a pass over a high ridge of sand-hills. This ridge commands the whole of the surrounding country, and is a very prominent feature in the landscape.

We camped for the night  $11\frac{1}{2}$  miles beyond the wells of Daudyr at a place without water. The sotnias arrived at 11.30 P.M., but the tail of the train not till 6 P.M. on the following day. The length of the march was 24 miles.

27th November  
9th December  
—At 10 A.M. the chief of the detachment and the staff, and a mixed Cossack section, made up from both the Orenburg and Ural sotnias, started for Urtakui to inspect the wells and dig new ones, if necessary. The rest of the échelon was to follow.

We reached the wells of Urtakui at 3.15 P.M. The length of the march was  $23\frac{1}{2}$  miles, the whole way through drift sands. In the 12th mile (72 miles from Gyaur-Kala) there is a well at Nefess-kui, but it did not contain more than 400 gallons of water. In the 15th mile a road branches off to the wells of Ikodja, 40 miles distant, on the same ridge as the wells of Daudyr.

At Urtakui there were two wells, containing slightly brackish water. One of them was not in good condition, the ground having given way. The chief of the detachment ordered it to be repaired during the night, so as to be ready by the morning. The work had to be done by the Cossacks who had accompanied the chief of the detachment, and with the intrenching tools that had been brought for the purpose.

The train of the échelon and the remainder of the Cossacks arrived at 10 P.M.  
28th November  
10th December  
—This was a day of rest for the 1st échelon. So as to be able to water all the camels, both of the 1st échelon and of the 2nd échelon, expected to arrive at Urtakui on the 29th  
11th  
and to avoid delay in the distribution of water to the men and horses during the halt, and in refilling the apparatus for carrying water for the impending march across the waterless tract to the wells of Igdy, the digging of four more wells was commenced on the morning of the

29th November  
10th December

After the arrival of the 2nd échelon each company had to dig one additional well for itself.

Of the water taken by the Cossacks from Kizyl Tchaghyldy and replenished at Gyaurl-Kala, there remained on arrival at Urtakui—with the Ural sotnia 400 gallons, and with the Orenburg sotnia 150 gallons.

At 3 P.M. the rocket section went through some practice firing. The results were fairly good.

At 6 P.M. the 2nd échelon arrived, and immediately set to work to dig three wells, which were completed by midnight, and were from 12 to 14 feet deep. The water in one of them was slightly brackish.

<sup>29th November</sup>  
<sup>11th December</sup>—A second day's halt. In the morning a tenth well was commenced for the lauches (native drivers).

On departure from Petro-Alexandrovsk the detachment had 900 camels; these were supplemented by 150 camels at Tchaghyldy. On the journey to Urtakui 27 had died, 118 had escaped with their drivers to the Khanate of Khiva, and 18 had been abandoned as unfit for work. There remained 887 camels and 153 native drivers.

<sup>30th November</sup>  
<sup>12th December</sup>—Both échelons left the wells of Urtakui, the infantry at 9 A.M., the cavalry at 10 A.M. The quantity of water taken for the waterless marches to the wells of Igdy was as follows:—

	Barrels.	Small barrels.	Skins.	Gallons.
By the infantry.....	130	—	21	2,980
"    Ural sotnia .....	34	—	165	2,060
"    Orenburg sotnia .....	27	4	80	1,265
"    artillery .....	10	—	14	330
Total .....				6,635

At 8.30 P.M. the detachment, having marched 28 miles, halted for the night at a place without water.

<sup>1st</sup>  
<sup>13th</sup> December.—The train and head of the column of infantry started at 7 A.M., the cavalry at 10 A.M.

The cavalry, having marched 18½ miles, halted, and after the whole train had passed it, moved forward again. The country was generally flat and the ground sandy. There was fodder (*Djuzan*<sup>1</sup>) for the horses in abundance. At the point where the cavalry halted for the train to overtake it, the road crosses the old bed of the Uzboi (Amu Darya).

On the eve of our departure from Urtakui, djighits had been sent on to examine the wells of Baba Ishem, 17 miles from Urtakui, and a mile or two to the side of the road. They reported that of the ten wells at Baba Ishem eight were filled up. There was water in the other two, but only in small quantities.

The detachment halted for the night at 8.30 P.M., having marched 29½ miles. There was no water at the encampment.

Ten miles beyond Urtakui the detachment met the djighits, who had been sent on to examine the wells, returning from Igdy. They reported that only two of the wells were not choked up. The water in them was almost fresh. They had noticed near the wells fresh traces of a considerable number of camels and horses, and of people—probably nomad Turkmen. In consequence of this 40 Cossacks, under the command of Sotnik<sup>2</sup> Kunakovskiy, were ordered to proceed without delay to Igdy and take possession of the wells. They were to take intrenching tools with them, and, besides guarding the wells, were to clear out those that were choked up.

<sup>1</sup> A desert plant.—J. J. L.

<sup>2</sup> Captain of Cossacks.—J. J. L.

The djighits also reported that it was not more than 14 miles from the encampment to Igdy.

<sup>2nd</sup>  
<sup>14th</sup> December.—The cavalry started from the bivouac at 8.30 A.M., and the infantry and the whole train at 9 A.M. The chief of the detachment went on in advance with the cavalry to the wells of Igdy, and arrived there at 11.15 A.M., having marched  $11\frac{1}{2}$  miles. From the wells of Urtakui to the wells of Igdy the total distance is 70 miles. During the first stage of 28 miles the road is through sand, with short intervals of hard sandy ground. At the 14th and 24th miles roads branch off to the east to the wells of Baba Ishem, approximately 30 miles off. There are two wells there. The water is at a depth of 5 feet. It is slightly brackish, but plentiful, and fit for cooking and drinking. 20 miles from Urtakui a road branches off to the west to Krasnovodsk. The wells of Khalym-adjik are the first met with on that road. In the 17th, 18th, and 21st miles hollows were met with, supposed to be the old bed of the Amu Darya. At the 22nd mile there was a depression in the form of a lake. The mountain of Ananak-pubé is on its bank. The second stage was  $29\frac{1}{2}$  miles. The ground is loamy for the first 6 miles. From the 7th to the 14th mile the low mountains of Kaplan-Kry run parallel to the road. The ruins of many burial places are visible on them, close to the road. In the 14th mile another track branches off to the wells of Baba Ishem. During the 18th mile the road crosses an ancient river bed. There is a native cemetery in the bed close to the road, and opposite it two dried-up wells. Two-thirds of a mile east of the road, there is some bitter saline water in the river bed.

The last stage to Igdy is  $11\frac{1}{2}$  miles. The road is through shifting sands the whole way. During the 6th, 10th, and 12th miles ancient river beds are crossed. The ascents and descents at the crossings are extremely difficult for camels.

At Igdy only two wells were found in good order. Two more were cleared out by the Cossacks sent on in advance the evening before. The remaining seven wells were to be cleared out by the troops after the arrival of the detachment. These wells (Great Igdy) are situate in the old bed of the Amu Darya. The water is slightly more brackish than at Urtakui. In one well it is much better than in the others. There are some small lakes in the river bed, but the water is bitter and salt.

Two miles before reaching Great Igdy, Little Igdy is passed. At the latter place there were five choked-up wells, and one which contained water fit for drinking purposes. One-sixth of a mile to the side of the road there are some wells in the bed of the Amu Darya, three of which contained brackish water. In the bottom of the bed there is a small lake with bitter and salt water. Its banks are overgrown with reeds.

The remains of a former Russian camp were found on an eminence close to the lake. It is probable that it had been a halting place of the detachment under Colonel Moskosov, which traversed the desert in 1873, but only got to within 6 miles of the wells of Urtakui, and returned to Krasnovodsk after suffering terrible privations. Many relics were seen lying about, such as fragments of spokes of wheels, gabions, bits of casks, old boots, bullets for Minié rifles, felt stockings, and other small articles.

The infantry and the whole train reached Great Igdy at 2 P.M. The troops were ordered to set to work immediately to clear out the wells, so that all the camels might be watered on the following day, and a store of water laid in for the further march.

The journey from the wells of Urtakui was accomplished more easily than had been anticipated. The actual distance agreed with that indicated on the map—70 miles. It was traversed in two and a half marches.

<sup>3rd</sup>  
<sup>15th</sup> December.—The wells were soon exhausted. In consequence of the

insufficiency of water the camels belonging to the infantry were sent to water at the wells of Little Igdy. Workmen were sent with the camels to clear out the wells.

The sanitary condition of the detachment was excellent. Only one man was ill. Eleven were weak, but fit for light duties.

For the further march from Igdy, the chief of the detachment selected the route direct to Bami, and not to Kizyl Arvat as had been previously intended. The reason of this change was, that the guides stated the latter route to be longer than shown on the maps, and that the road as far as the wells of Dinar was exceedingly bad (through deep sand).

<sup>4</sup>/<sub>16</sub>th December.—The infantry and train started at 8 A.M., the cavalry at 8.45. For  $2\frac{3}{4}$  miles the road was along the bed of the Uzboi. A good deal of water was met with, but it was all brackish and bitter. In the 2nd mile from Igdy there are traces of an ancient rapid  $10\frac{1}{2}$  feet deep.

At 7 P.M. a total eclipse of the moon commenced, rendering the march of the train difficult. In the darkness it was next to impossible to distinguish the road, which crossed many sandy hillocks with small clay flats (*takyrs*) occasionally intervening. The eclipse of the moon was over at 11 P.M. At 11.30 P.M. the detachment, having marched  $32\frac{3}{4}$  miles, halted for the night at a spot where there was no water.

<sup>5</sup>/<sub>17</sub>th December.—In anticipation of a sudden encounter with Turkmen, traces of whom had been seen on the road on the previous evening, the chief of the detachment issued fresh instructions for the order of march, as follows:—

In the first échelon, which was to be composed of infantry, one company was to march at the head of the column. It was to send out an advanced guard, which in its turn was to send patrols ahead and to the flanks. The guns were to march behind the first company, and then a large part of the infantry train, one private being told off for every fifteen camels of the train to form an escort. In the middle of the échelon another company was to march, forming a compact body, and the main protection of the train. It was to send out flanking patrols, two to each side from 200 to 300 paces from the road. The third company was to be at the tail of the train, and was to furnish a rear guard. A few Cossacks were told off to march with the infantry. Four were to be sent out to each side, to constitute more distant flanking patrols or reconnaissance parties at 500 paces from the road. Three Cossacks were to march at the head of the infantry advanced guard, two were to accompany the Officer making sketches, and were to measure the road with a chain, and two others were to act as orderlies to the Officer commanding the infantry.

The second échelon, consisting of the cavalry with its train, was to follow immediately after the first, marching in the following order:—One section of cavalry at the head of the train, and another as rear guard. One section was to be sent out on each flank to a distance of from  $\frac{3}{4}$  to  $1\frac{1}{2}$  miles, according to the locality. One Cossack was to be told off to every twenty-five camels as escort for the train. The second sotnia and the rocket section were to march in rear of the train, and form a compact body ready to move wherever they were wanted—to the head, centre, or rear of the column.

The arrangements for guarding the bivouac at night were to be as follows:—

The detachment was to bivouac in a square. Each company and sotnia was to tell off one section for duty. These sections were not to sleep in the *yoorts*,<sup>1</sup> but were to remain in the open, and close to their arms, which were to be piled. The guns were to be uncovered and loaded with case shot, and rockets were to be placed in the rocket-troughs. Each section on duty was to send out two picquets to form a chain round the camp.

<sup>1</sup> Turkmen tents.—J. J. L.

At dawn the camels were to be driven out of the camp to feed, each unit providing an escort of six men. The chain of picquets were to move farther out so as to increase the space enclosed.

The men on guard were not to lie down, but to remain on their feet till it became quite light.

Leaving the bivouac at 10.15 A.M., the chief of the detachment outstripped the train of both échelons, and proceeded to the wells of Sansyz, taking the Orenburg sotnia and the rocket section with him.<sup>1</sup>

At 12.45 he reached the wells of Sansyz, 10 $\frac{2}{3}$  miles from the last camp. There were twenty wells, but only six of them contained water. In one of them the water was only slightly brackish, and could be drunk in case of necessity. In the others it was bitter and salt, and injurious to the health. Fourteen of the wells contained no water at all. Some of them were as much as 70 feet deep.

As the guides asserted that the wells of Tchadyr were only 2 miles beyond Sansyz, and contained bitter saline water, the chief of the detachment, being anxious to water the camels, sent an Officer and 20 Cossacks to investigate them, and explore the road. The party returned in about an hour and a half, and reported that the wells were not 2, but 4 $\frac{2}{3}$  miles off, and that there was but little water, and that was bitter and saline.

The detachment reached the wells of Sansyz at 2 P.M., and encamped.

18th December.—The detachment advanced from Sansyz in the same order as on the preceding day. The 2nd échelon (infantry) marched at 2 A.M., and the 1st échelon (cavalry) at 3 A.M. The troops marched without halting till 3.45 P.M., performing a distance of 30 $\frac{3}{4}$  miles. There was no water at the halting place, known by the name of "Devlet Tepez." Tapyz is the usual name for flats with a soft surface from which salt oozes out, situated in the midst of sand hills. 3 $\frac{1}{2}$  miles before reaching the camping grounds, and  $\frac{1}{2}$  mile to the right of the road, the flanking patrol found some abandoned kibitkas, some old and bad felt rugs, and many old and useless household utensils.

They were evidently the remains of a nomad Turkman encampment, abandoned in consequence of the march of the Turkestan detachment.

On arrival at Devlet Tepez the reserve of water was as follows:—With the infantry, 2,335 gallons, with the Orenburg sotnia, 585 gallons, and with the Ural sotnia, 1,110 gallons. After the expenditure at the encampment there remained:—With the infantry, 995 gallons, after giving 270 gallons to the Orenburg sotnia, which even then had only 345 gallons, and with the Ural sotnia 342 gallons.

19th December.—The march was continued towards Bami. The advanced guard of the infantry and the train started at 9.30 A.M., followed by the train of the cavalry. The order of march was the same as on the preceding days. Eight miles from the bivouac, traces of flocks and camels, which had gone in the direction of the oasis to the east of the route of the detachment, were observed. A Cossack patrol, under an Officer, followed these traces for 2 $\frac{2}{3}$  miles, but discovered nothing more. After marching 12 miles, the detachment reached the wells of Nyaz, situated, consequently, 42 $\frac{1}{2}$  miles from Sansyz. There are seven wells, but they were all choked up.

The chief of the detachment accompanied by the cavalry arrived at the wells of Nyaz before the infantry and train. He immediately gave orders to send forward two cavalry patrols, as a picquet posted on a pretty high sand hill just above the wells, had reported a large column to be in sight. It was possible to distinguish horsemen and camels. This occurred about 1.30 P.M.

While awaiting further information about the column seen in the distance, the sotnias and rocket section halted at the wells. The patrols soon brought

<sup>1</sup> As regards these troops, the orders just mentioned do not appear to have been observed.—J. J. L.

back the information that the column was a transport train with water, sent from Bami to meet the Turkestan detachment. Leaving a piquet on the hill, the chief of the detachment went forward with the rest of the cavalry to meet the column. After proceeding two miles along the road to Bami they met a company of the Apsheron regiment<sup>1</sup> conveying a transport column carrying 100 barrels of water. This water had been sent from Bami by the commandant, at the request of Colonel Kuropatkin. A djight had been sent from Igdy to Bami to report the approximate time of arrival of the Turkestan detachment at the Akhal Tekké oasis, and to request that a small party might be sent to clear out the wells of Nyaz, which Khorunji Stetsenko had reported as choked up. If there were difficulties in the way of despatching a party for this purpose, it was requested that water might be sent.

After proceeding  $\frac{2}{3}$  mile further, Colonel Kuropatkin halted the cavalry to await the arrival of the train and infantry. He proposed to the Caucasian company to turn back with its transport column, and after marching  $5\frac{1}{2}$  miles to halt for the night at a spot where the Turkestan detachment would join it.

After the infantry and train had come up, the whole detachment pushed forward till 6.30 p.m., when the spot was reached, where the company of the Apsheron regiment was already encamped.

The length of the day's march was  $20\frac{2}{3}$  miles. The water brought by the Caucasian company, amounting to 800—950 gallons, was all given to the sotnias. The infantry did not require any, as they still had 1,030 gallons on arrival at the camp. With this they could easily have marched two days more. It was decided to expend all the water carried by the troops on the following day.

<sup>26</sup>th December.—The train started at 10 A.M., followed by the infantry and cavalry. The non-commissioned officers and men of the infantry marched on foot. The train moved in two columns on a front of several files, as the country was fairly level. The sands ceased  $2\frac{2}{3}$  miles beyond the wells of Nyaz.

Major-General Petrusevitch, assistant to the Commandant of the troops in the Trans-Caspian district, rode out to meet the detachment about 3 miles from Bami. He was accompanied by Colonel Verjbitsky, Commandant of Bami, and many other Officers.

Bami was reached about 3 P.M. The length of the march was  $13\frac{1}{3}$  miles.

A dinner was given that day to the Officers and men of the Turkestan detachment by the troops stationed at Bami.

The meeting of the Turkestan and Trans-Caspian troops was most cordial.

The Turkestan detachment camped by itself at a place close to the fort.

Of the whole march from Petro-Alexandrovsk to Bami, the section from Igdy to Bami was the most difficult. The length of this section is 108 miles. The country, except for the 16 miles nearest to the fort of Bami, is a constant succession of hillocks of drift sand, difficult to traverse even in winter.

The first march from Igdy was  $32\frac{2}{3}$  miles. The first  $2\frac{2}{3}$  miles were along the bed of the Uzboi, and beyond that the road lay through drift sands, varied occasionally by salt marshes. In the third mile a road to Kizyl Arvat branches off to the west, the first wells on it being at Purrok,  $66\frac{2}{3}$  miles off.

The second stage after leaving Igdy to the wells of Sansyz was only  $10\frac{2}{3}$  miles, the whole way through drift sands.  $33\frac{1}{3}$  miles to the east of Sansyz are the wells of Tenir-Ajan. The third stage was  $30\frac{2}{3}$  miles through drift sands. In the fourth mile of this stage the *tapyz* (salt flat) of Kutchin is situated. It contains a large pit in which rain water collects at the time of the rains.  $16\frac{2}{3}$  miles beyond the second halting place the *tapyz* of Kurt-Kuzlan is reached. Just before it there is a difficult pass over a high ridge of sand hills. The *tapyz* of Yun-Kitchkan is in the twenty-second mile, and

<sup>1</sup> The 81st Regiment of the 21st Infantry Division.—J. J. L.

that of Bek-Atyr in the twenty-third. At the latter, three wells had been dug. The place of bivouac was called Devlet Tepez. 20 miles beyond it are the wells of Tchupyn-kaky, with brackish water. The 4th stage,  $20\frac{2}{3}$  miles long, was across big hillocks of drift sand for  $17\frac{1}{2}$  miles, and then over a salt marsh overgrown with *djuzan*. The wells of Nyaz were met with in the fourteenth mile of this stage. There are seven wells, 35 feet deep. The water is brackish and unfit for food. The wells were all choked up. The fifth stage was  $13\frac{1}{2}$  miles. The road continues to cross a salt marsh overgrown with *djuzan*.

The total distance marched by the detachment from Petro-Alexandrovsk to Bami was  $448\frac{2}{3}$  miles; of these  $338\frac{2}{3}$  miles, from Tchaghyl to Bami, were across the desert, and occupied eighteen days. The average distance traversed on the fourteen days of actual march was 24 miles.

Between Gyaur-Kala and Bami the camels were only watered twice.<sup>1</sup>

887 camels started from Igdy with the detachment, 52 died or were abandoned on the march. On arrival at Bami, 835 remained, but 17 of them were so weak as to be unfit for further work.

The sanitary condition of the *personnel* of the detachment was excellent. On arrival at Bami only two men were ill, and 107 were weak.

The state of the weather during the march from Petro-Alexandrovsk to Bami was as follows:—

Mean temperature at 7 A.M.....	30° 65 F.
1 P.M.....	50° F.
7 P.M.....	32° 75 F.
of the day.....	39° 87 F.

Number of windy days, 5; cloudy, 6; rainy, 1.

The Turkestan detachment remained halted for two days before proceeding from Bami to Denghil Tépé. During this time it was busily engaged making good damages to clothing and equipment, in reorganizing the camel train, and in receiving fresh supplies of provisions and forage.

#### APPENDIX.

*Itinerary of the March of the Turkestan Detachment from Petro-Alexandrovsk to Bami in 1880.*

From	To	Distances in miles.		Dates of arrival.	Remarks.
		Inter-mediate.	Total.		
Petro-Alexandrovsk.	Shabaz Vali .....	20	..	Nov. 24	Day occupied in crossing the Amu Darya.
	Gurlenskaya Ferry	$20\frac{2}{3}$	..	" 25	
				" 26	
	Sheikh Kala .....	30	..	" 27	
	Khodja Kumbet ..	$23\frac{1}{2}$	..	" 28	

<sup>1</sup> The detachment left Gyaur-Kala on the 7th December, and reached Bami on the 20th. Distance 262 miles.—J. J. L.

From	To	Distances in miles.		Dates of arrival.	Remarks.
		Intermediate.	Total.		
Petro-Alexandrovsk.	Tchaghyl.....	18 $\frac{2}{3}$	110 <sup>1</sup>	Nov. 29	
				" 30	Halt to complete the organization of the train.
				Dec. 1	The detachment moved to an encampment a few miles off the road, on the banks of Lake Kizyl-tcha-Ghyldy.
				" 2	Detachment remained halted.
	Kizyl-tcha-Kuyussi	40	150	" 3	
				" 4	The cavalry remained at Kizyl-tcha-Kuyussi to await the arrival of its train.
	Shakht Senem....	17	167	" 5	
	Gyaur-Kala.....	20	187	" 6	All water barrels and skins filled up.
	(No name).....	20	207	" 7	Halt for four hours at a place with no water.
	".....	18 $\frac{2}{3}$	225 $\frac{2}{3}$	" 8	A night march. No water at halting place.
	".....	24	249 $\frac{2}{3}$	" 8	No water at halting-place, but horses had been watered at Daudyr, half-way from previous halt.
	Urtakui.....	23 $\frac{1}{3}$	273	" 9	
				" 10	Fresh wells dug. Halt.
				" 11	Day of rest. Barrels and skins refilled.
	(No name).....	28	301	" 12	No water.
	".....	29 $\frac{1}{3}$	330 $\frac{1}{3}$	" 13	No water.
	Great Igdy.....	11 $\frac{1}{3}$	341 $\frac{2}{3}$	" 14	Water fit for drinking and cooking purposes.
				" 15	Day of rest. Water barrels, &c., replenished.
	(No name).....	32 $\frac{2}{3}$	374 $\frac{1}{3}$	" 16	No water.
	Sansyz.....	10 $\frac{2}{3}$	385	" 17	One well contained water fit to drink in case of necessity.
	Devlet Tepez....	30 $\frac{2}{3}$	415 $\frac{2}{3}$	" 18	
	(No name).....	20 $\frac{2}{3}$	436 $\frac{1}{3}$	" 19	No water.
	Bami.....	13 $\frac{1}{3}$	449 $\frac{2}{3}$	" 20	No water.

<sup>1</sup> This is mentioned as the total distance from Petro-Alexandrovsk to the wells of Tchaghyl, but does not quite agree with the sum of the intermediate distances.—J. J. L.

## THE GERMAN FIELD POST.

Translated from the *Unteroffizier Zeitung*, of 29th July, and 3rd August, 1881,  
by Major G. BARTON, Royal Fusiliers.

*The Field Post.*

THE "Field Post" may be regarded as an important branch of the administrative organization, requisite for an army which has taken the field ; especially as being the means of maintaining an intimate connection between the fighting men on the battle-field and those left at home ; and also as being the bringer of tidings of the gallant deeds of armies, and of all the longed-for despatches, to millions of expectant hearts.

This formed the subject of a lecture recently delivered in the club of Old Comrades of the Railway regiment, by Captain (of Landwehr) Boettcher, from which we extract the following :—

On mobilization of the army there are established for the region of each mobilized army corps : one Field Post Office under a Field Postmaster, and four Field Post sub-offices, each under a Field Post secretary, *i.e.*, one Field Post Office for each of the two infantry divisions, the third for the corps artillery, and the fourth in reserve. The latter, the Reserve Field Post Offices, are intended for the cavalry divisions and for any Reserve divisions which may be formed. Their disposal is arranged for, in case of mobilization, by the War Ministry, in communication with the General Post Office. All the Reserve Post Offices, which are not immediately required, remain for the time at the place of mobilization. In the event of several mobilized army corps being placed under the command of one supreme Commander, a separate Field Post Office is established for this army command. On mobilization of the entire army, a special Field Post Office is opened, in addition to the others, for the headquarters. Besides these regular Field Post establishments, additional so-called Field Post stations, or Etappen Post establishments, are set up, according to requirements, at suitable points on the lines of communication, for the purpose of maintaining secure postal connection between the operating army and the home country.

At the advanced Etappen dépôt, the communications to the several army corps, divisions, &c., branch off from the main Etappen Post lines. Thus, *e.g.*, a system of twenty-eight Field Post lines was available for the Second Army, which consisted at first of seven army corps.

Since an army is being perpetually hurried hither and thither, these Field Post lines must be adapted, with the greatest circumspection and rapidity, to the movements of the troops ; in fact, constantly altered and regulated. The last campaign illustrates plainly what the Field Post underwent in this respect. For example, on the day of the battle of Noiseville (31st August) it was as though we were at home and in peace time. The Post reached, at the previously appointed hour, the Post Offices of the 1st and 7th Army Corps, which were in bivouac near the battle-field. The letters which had arrived were immediately sorted, in the early morning, and delivered to the troops, who fetched them, or delivered to them by intermediate stages. Thus many an eye, that afterwards closed in death, was enabled to gain courage from words of love before the commencement of the fight.

On the day after the battle of St. Privat la Montagne, one of the many days so full of glory for the 12th Corps, the Field Post erected its office table at first dawn of day in the midst of the dead and wounded. Hundreds of soldiers hastened at once to hand in letters and postcards. As early as the

same afternoon, eight large sacks full of letters were despatched homewards, where they arrived in sixty-eight hours.

The establishing of this Field Post line, as well as the arrangement of the Étappen Post Offices for the region of each separate army, is entrusted to an Army Post Director, to whom are attached three Army Post Inspectors, for the purpose of supervising the work.

The Army Post Director is charged both with the direction of the Field Post Office of the army headquarters, and with the supervision of business at all the remaining Field Post Offices in the army region. For the first requirements, thirty Field Post secretaries and twenty Field Post managers are placed at his disposal, to assist in the work of the offices and accounts, and for the charge of postal duties in the Étappen Post establishments. The Army Post Director follows the army at once with this staff, and leaves one or more employés, according to requirements, at all places on the line of communications. Thus a chain of postal establishments is formed at once in rear of every army, which have to maintain by every available means the postal communication with the home country. Another example from the late campaign may best be taken to illustrate what a task this is.

Before the fortresses, situated on the main line of railway—Paris, Strasbourg, Rheims, Metz, &c.—fell into German hands, the railways could not be utilized for the through carriage of the Post. It only remained, therefore, to seek out the old high roads again, which had long since been abandoned by commercial traffic, and to render them fit for the direct passage of the Post, by establishing stations at which an adequate supply of transport material was kept ready. When the Royal headquarters had reached Ferrières, in its rapid advance on Paris, a Courier Post was established on the Imperial route, to Rémilly by Pont-à-Mousson, Bar-le-Duc, Eprenay, to Ferrières, giving most rapid communication with Berlin. The courier had to pass 15 stages, which were furnished with 180 horses; he covered the distance of nearly 238 English miles in about 30 hours; so that, with the help of the railway as far as Rémilly, letters from Berlin reached Ferrières, about 709 miles, in 70 hours. In 1814, our forefathers only received the letters giving the accounts of the victories of La Rothière, Laon, La Fère, Champenoise, after a lapse of fourteen or sixteen days.

After the fall of the enemy's fortresses Field Railway Posts were established at once on the lines of railway, which by the 5th of December were open as far as Lagny, 24 miles from the gates of Paris.

On mobilization, a dépôt of Post-horses and wagons is established for each army, chiefly for the service of this Étappen postal system; it is placed under a superintending Field Post Secretary. The dépôt consists of the above official as superintendent, a veterinary surgeon (civilian), 10 Field Post messengers, 30 Field postilions, and 1 detachment of the Train department; the material consists of 30 pair-horse wagons, and 90 draught horses.

The proper management and supervision of the entire postal communication on the theatre of war is entrusted to a Field Chief Postmaster, who, together with 2 Field Chief Post Inspectors and 4 Field Post Chief Secretaries intended for the office work, are attached to the Inspector-General of the Étappen and railway systems. The management of the entire postal system and Field Post establishments of the Army is placed under the Field Chief Postmaster, and he is further charged with the control of the Field Post Office specially established for the headquarters.

To sum up the above briefly, we find:

- 1, At headquarters, the Field Chief Postmaster; 2, with each army command an Army Post Director; 3, with each army corps a Field Postmaster; 4, with each division a Field Post Chief Secretary as overseer. These officials are placed, as far as all matters other than postal duties are concerned: 1, in infantry or cavalry divisions under the Commanders of the

respective divisions ; in the corps artillery under the artillery Commanders ; 2, in army corps under the Chief of the Staff of the corps ; in army commands (a) the carriage of the Field Post under the Quartermaster-General, (b) the Army Post direction under the Chief of the Staff of the particular army, and, as far as concerns the postal duties on the lines of communication, under the Inspector-General of the lines ; 4, at the chief headquarters, (a) the Field Post Office under the Quartermaster-General, (b) the Field Chief Postmaster, under the Inspector-General of Communications and Railways ; 5, the *Étappen* Post establishments and the *depôts* for post horses and wagons receive their orders, in all military matters, from the *Étappen* Inspector of the Army, through the Army Post Director, or in special cases through the Officer commanding at the particular place. The following is the *personnel* employed in the actual Field Post establishments of the entire force, reckoning the same as 18 army corps, organized in 4 armies :— 1 Field Chief Postmaster, 2 Field Chief Post Inspectors, 4 Army Post Directors, 12 Army Post Inspectors, 18 Field Postmasters, 72 Field Post Chief Secretaries, 288 Field Post Secretaries ; further, for the headquarters of the different armies, and the Army Post administrations, as well as in the offices, are employed : 9 Field Post Chief Secretaries, 130 Field Post Secretaries ; in all 536 officials. To these must be added : 424 Field Post messengers and 566 Field postilions ; thus giving a total of 1,526 employés.

Further have to be reckoned : 4 veterinary surgeons (civilians) and 540 soldiers of the Train department, so that the Field Post at once takes the field with a strength of 2,070 men.

This, however, is only the first contingent, and at the same time the framework of the entire system, which, according to the duration of the war and the greatness of the distances, soon calls more into existence ; when, for example, the Post undertakes the delivery of parcels, which is at first excluded.

Thus in 1870, from the parcel office in Lagny (where about a million parcels were lying) 1,000 wagon-loads of parcels had to be sent long distances after those regiments which were unable to fetch them themselves, because they were actively engaged, *e.g.*, for the 17th and 22nd Divisions, as far as Chartres by Corbeil and Etamp, 84 miles.

For the above *depôt* 350 horses and a large wagon park had to be supplied.

As a matter of course the entire *personnel* of the Field Post is kept ready appointed in peace time, and the name of the official for each position is known to the army Commanders, and to the War Ministry ; these lists are also kept so perfectly that, by a mere stroke of the pen, the Field Post can be set in complete working order as far as the frontier ; for it invariably hastens forward in advance of the troops.

The chief difficulties consist in procuring horses, which have to be purchased in open market, on account for the War Ministry, by the Post Office authorities, and always by the chief Post Office administrator of the district in which the place of mobilizing the Field Post Office establishment is situated. Once purchased, the horses become the property of the military department, which has to arrange for keeping up the supply during the period of mobilization. The number of horses which has to be purchased is not inconsiderable, when it is remembered that every Field Post Secretary receives one horse, and all officials above this rank are supplied with two horses ; and also that, in addition to the establishment of draught horses, a considerable reserve has to be maintained.

According to the before-named conditions of mobilization, 762 riding horses are required for 536 officials, and 1,014 draught horses for the 434 Field Post wagons, which have to be horsed at first ; in all 1,776 horses.

As soon as the mobilization is completed, and the armies commence to march, the Field Post establishments move forward with the headquarters

Staff of each army command. Between these headquarters and the home country the *Étappen* postal system is established, and in order to simplify the postal traffic, in the home country itself, large towns, which are favourably situated for the purpose, are fixed on as collecting stations—central working places—to which all consignments from the provinces are addressed, to be packed in sacks and sent to the respective Field Post Officers.

Thus in 1870–71, collecting stations were established in Berlin, Hamburg, Leipzig, Cassel, Cologne, Frankfort-on-Main, and Saarbrücken. These central stations employ a very numerous staff, *e.g.*, in Berlin, at times 150 officials; in such cases it was necessary to erect large specially adapted buildings, fitted with every requisite appliance, in order to deal with the masses of letters. The last-named collecting station despatched at times as many as 300,000 letters daily. The enormous quantity to which the number of home letters amounted by the time they reached their destination may be gathered from the fact that the daily transport for the letters of the Army of the Meuse consisted often of seven pair-horse wagons, in fact, a regular column, which had to be despatched daily, and escorted about 238 miles by road from Pont-à-Mousson, under the guns of Verdun, and thence through the dangerous passes of the Argonne Forest to Dommartin and Margency.

Of the mode of despatch, the regulations and the manner of treating consignments by post, we will only mention what may perhaps be of interest and use on possible future occasions.

Private letters, &c., of the military, and of military officials are sent as follows:—

1. Ordinary letters up to 250 grammes<sup>1</sup> weight, postcards and postal orders up to the weight of 250 grammes, and value of 150 marks, free of charge.
2. Letters over 250 grammes, and postal orders over 250 grammes, and up to the value of 1,500 marks inclusive, as well as registered letters, on payment of postage.
3. Post Office orders, from the army, for amounts not exceeding 150 marks.
4. Newspapers regularly taken in and sent under special cover.

A difference is made between “rapid correspondence” and “soldiers’ letters.”

The following are excluded from despatch:—

1. Consignments with
2. Postal commissions.
3. Post Office orders to the troops in the field.
4. Also at first, parcels.

The superscriptions “to wait till called for” and “to be delivered by special messenger,” are not permitted for letters going to the troops.

In addition to the customary requirements regarding the nature of consignments by post, the following rules regarding articles sent by the Field Post must be observed:—

1. All consignments of a private nature, sent to or from the army, must have the mark “Field Post letter” added to the address.
2. All consignments sent to the troops must specify on the address, exactly, the army corps, division, regiment, battalion, and company; and similarly the squadron or battery; as well as the rank and position of the addressee, or the office of the department.
3. In the case of consignments sent by the military or military officials, if

<sup>1</sup> 8·1 ozs.

the sender holds Officer's rank, he must, in addition to the mark "Field Post letter," sign it, as the sender, with his name and rank.

4. In paying in the amount for Post Office orders, the payment must be made in German money, or such foreign money as has a current rate of exchange fixed by the military authorities; and the sender must give his name.

It is further recommended, for the sender to note his name on all consignments by post.

Postage is charged as follows :—

1. Ordinary letters over 250 grammes, 20 pfenniges<sup>1</sup>; 2. Postal orders over 250 grammes, up to 150 marks, 20 pfenniges; 3. Postal orders from 150 up to 300 marks (without difference in weight), 20 pfenniges; from 300 to 1,500 marks (without difference in weight), 40 pfenniges; and moreover, all articles chargeable with postage must always be prepaid.

Unpaid articles are not despatched, and are treated as not deliverable.

All letters, &c., must be fetched from the Field Post Offices; the principal headquarters and the headquarters of the different armies alone form an exception to this rule; their despatches are delivered by Field Post messengers.

As regards the uniform of the Field Post employés, this has been considerably altered since the last campaign; for, on the reorganization of the German Imperial Post,<sup>2</sup> opportunity was taken to introduce a new Imperial Post uniform, and this has since undergone another alteration.

The Field Post official wears a dark blue coat, with stand-up collar of dark blue velvet, on which the distinctions of rank are displayed, also golden shoulder-knots with rouge-coloured lining, with or without stars. (a) The Field Post Secretary has narrow lace on the collar, with two stars on either side, and shoulder-knots without stars. (b) The Field Post Chief Secretary lace of one finger's breadth on the collar without stars, and shoulder-knots, each with one star. (c) The Field Postmaster and the Army Post Inspectors the same lace with a star on each side, shoulder-knots with two stars. (d) The Army Post Director and the Field Post Chief Inspectors wear the broad lace, and below it the narrow lace of the Field Post Secretaries, without stars; also twisted shoulder-knots of the same description as Staff Officers. (e) The Chief Field Postmaster, the same two kinds of lace, the same shoulder-knots, but a star on either side of the collar, and also on the shoulder-knots.

All Field Post employés wear the helmet prescribed for officials, with heraldic eagle, and the cavalry sword as side-arm; also tight pantaloons and long boots. The uniform of the subordinates in the Field Post is the same as that worn in peace time.

It still remains to add a few statistics of universal interest for the accuracy of which a Lieutenant in the Reserve, Post Chief Secretary Stoessner, vouches.

During the period, 16th July, 1870, to 31st March, 1871, the following were despatched to and from the Army of North Germany only, viz. :—89,659,000 letters and postcards; 2,354,310 newspapers; 36,705 military official money remittances, of the total value of 43,023,460 thalers<sup>2</sup>; 2,379,020 private money remittances of the total value of 16,842,460 thalers; of this sum about 5,000 thalers were lost in consequence of attacks by the enemy; 125,916 military official parcels; 1,853,686 parcels for soldiers. There were 411 Field Post establishments on the theatre of war.

The personnel of the Field Post, inclusive of the reserve of officials, consisted of 1,826 men.

314 officials were sent to Rheims and to Alsace and Lorraine. Besides these,

<sup>1</sup> About 2½d.

<sup>2</sup> Thaler = 3s.

3,761 officials were recalled to the colours, so that 5,901 men of the Post Office department were in the field.

In transport material were employed 1,933 horses and 465 vehicles.

The total outlay for the Post Office administration, from the commencement of the mobilization to the end of March, 1871, amounted for field purposes to about one and a-half million thalers.

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## NOTICE OF BOOK.

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*Military Transport.* By Lieut.-Col. G. A. Furse, D.A.Q.M.G. London: Printed under the superintendence of Her Majesty's Stationery Office, 1882. Size, 9 $\frac{3}{4}$ " x 6" x  $\frac{3}{4}$ ". Weight, 1 lb. 5 ozs.: pp. 305. Price, 5s.

THE preface gives the object and scope of the work.

"The reports on the late Afghan and Zulu Wars have confirmed the often-repeated assertion that one of the greatest difficulties of our military transport on service lies in the inexperience of the Officers appointed to do duty with it. If circumstances do not permit of our Officers acquiring by a previous training a certain degree of practical experience in army transport before the outbreak of hostilities, still it may be conceded that they can familiarize themselves through study with the details of this very important military requirement. With this object in view these pages have been written, and, though no one realizes better than myself both the difficulty of the subject and my inadequacy to deal with it properly, I have not been deterred from publishing the result of my studies, trusting that in time the subject may be ably dealt with by some better qualified Officer.

"That the question of military transport is not the most attractive part of the study of the art of war, I will readily concede, still it must be admitted that a better knowledge of it than most of us at present possess will be the means of saving the country in a future war many thousands of pounds, and will prove of the greatest assistance to the Officer entrusted with the direction of military operations.

"The efficiency of our army transport on service rests on the degree of attention paid to it in peace-time. We should not rest satisfied with censuring when a war discloses a sad failure in our transport arrangements, but in the leisure times of peace which follow it, we should frame on our past experience such an organization as will put the possibility of a failure recurring entirely out of the question.

"The compilation of this book has only been possible, owing to the information derived from the recorded experience of many able writers, and it is just to acknowledge that their works have been unsparingly used."

Considering the amount of study the author has given for a long time past to the subject (as evidenced by his former publication), and the position he occupies at Head Quarters, so favourable for obtaining information, the book may be regarded as a complete and full treatise well up to date.—L. A. H.



